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SUBCONJUNCTIVAL CAUTERIZATION OF THE SCLERA OVER THE CILIARY BODY WITH THE GALVANO-CAUTERY TO REDUCE INTRAOCULAR PRESSURE IN ADVANCED GLAUCOMA. PRELIMINARY REPORT . . . . . E. J. CURRAN

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ARCHIVES OF OPHTHALMOLOGY.

SUBCONJUNCTIVAL CAUTERIZATION OF THE SCLERA OVER THE CILIARY BODY WITH THE GALVANO-CAUTERY TO REDUCE INTRAOCULAR PRESSURE IN ADVANCED GLAUCOMA. PRELIMINARY REPORT.[1]

By Dr. E. J. CURRAN, Kansas City.

(From the Department of Ophthalmology, Medical School, University of Kansas.)

THE preservation of the eyeball in absolute glaucoma which is giving pain or discomfort to the patient, or the saving of what little sight or even light perception there may be in advanced cases of primary and secondary glaucoma, presents a problem which we are often called upon to meet. Any operative procedure is beset with difficulties, the chief of which is immediate intraocular hemorrhage. These eyes have usually been under great pressure for a long time and the blood vessels are in such a condition that they are unable to withstand any sudden relief of pressure such as must happen if any of the radical operations are undertaken in which there is a sudden loss of aqueous.

This preliminary report concerns experiments by subconjunctival cautery in cases of this kind, but the results may be useful for other more promising cases when we learn more as to permanency and ultimate safety of the procedure. Up to the present time I have tried it on eyes only as a last resort, and a sufficiently long time has not passed to enable one to properly estimate its value. We are dealing with

[1] Read before Ophth. Section, N. Y. Acad. Med.

emergencies which do not respond to local or general treatment, and in which the accepted operations are fraught with great danger. Any new method of attack which lessens the danger of post-operative hemorrhage and gives even temporary relief in such cases is a step forward.

Whatever we do along the line of operative procedure for the relief of glaucoma involves purely a mechanical problem and if we wish to sum up the possibilities from a mechanical point of view we are safe in saying that there are three ways in which we may reduce the intraocular pressure and maintain the balance of fluid in the eye at a pressure approaching normal.

1. Increase of the outflow of the fluid from the eye. (Iridectomy, Iridotomy, Sclerectomy, etc.)

2. Lessen the inflow of fluid in the eye.

3. Make more elastic the retaining walls of the eyeball. (Nature does this in infantile glaucoma and thus saves at least some sight which enables the patients in many cases to get about unassisted to the end of their lives.)

The increase in the exit of fluid from the eye has been the most exploited of all these possibilities. The latter two have been little worked upon from an operative standpoint.

Over a year ago a colored man of 28 years appeared at the Clinic of the Medical School of the University of Kansas with a ciliary staphyloma and an intraocular pressure of 3*mm* above the upper limits of normal. He had a markedly contracted field of vision on the nasal side and atrophy of the optic nerve with glaucomatous (not atrophic) cupping of the disk. The history indicated that he had had glaucoma. There was a four plus Wassermann reaction which would suggest that there may have been a gumma, the healing of which would weaken the tissue over the ciliary region. The vision was, with correction, $\frac{1}{4}\frac{0}{0}$, which, according to the patient, remained the same from the time that the staphyloma was fully developed. Our conclusion was that this was a spontaneous cure of the high tension which may have been caused by syphilis but helped by the probable healing of the ciliary gumma under treatment. We have seen cases of known glaucoma in young people with low intraocular pressure and the formation of staphylomata. The intraocular pressure in in-

fantile glaucoma is relieved by the stretching of the sclera and cornea and we thus have hydrophthalmus. It follows that if we could produce a staphyloma it would act as a decompression does in the skull, and we might get a reduction of tension without entering the eyeball. Several attempts were made to produce this in various parts of the eyeball by destruction of tissue by subjunctival cautery, but without results of a satisfactory nature, excepting in one instance, although we imagined that if we had sufficient courage to destroy a large area of sclera we could produce sufficient elasticity of the retaining wall in that area to accomplish the end in view. In our present attitude towards these cases, hopeless though they may be, we had not sufficient courage to destroy a great area of sclera which, according to reason unsupported by experiment, seemed to be the right thing to do. It was then decided to try to produce a staphyloma in the ciliary region with the further hope of putting out of function a part of the ciliary body by slow conduction of heat of the deeper tissue and thus reduce the amount of aqueous formation, as well as getting the effect of decompression, with the surprising result that although no staphyloma was produced, at least in the beginning, the tension fell markedly in each case, for a short time. This was a great benefit in the cases experimented on, even though in some it proved to be only temporary. What better preparation for a more radical operation could there be? Fortunately some of the good results appear to be permanent.

Examination of the literature showed that the effects of heat on the reduction of intraocular pressure and on the structures of the eye applied in measured degrees have been studied by Shahan, Post, and Lamb[1] of St. Louis, Missouri. Shahan and Post used the thermophore in glaucoma and found reduction of intraocular pressure. Whether this was temporary or permanent it was an important advance which might be taken hold of in research in the treatment of glau-

[1] Shahan, W. E., and Lamb, H. D. "Histologic effects of heat on eye." *Amer. J. Ophth.*, 33: 255 (Abs). *Ophth. Year Book*, 1916, xiii., 31: 332.

Shahan, W. E., and Post, Lawrence. "Thermophore studies in glaucoma." *A. J. Ophth.*, 1921, Feb. 4: 108–118.

coma. One notable change according to the authors was atrophy of the iris over the region of applied heat. Atrophy of the ciliary body also might be expected. It was noted that in some cases the conjunctiva was destroyed on the application of prolonged heat over this area. I do not know how long the good effect of these experiments lasted, but even if they were only temporary their significance should not be disregarded. These authors have done much original research on the effects of heat on the eye in connection with other diseases such as corneal ulcers, etc. From their studies it is surprising to learn how much heat can be directly applied to the surface of the eyeball without permanent damage to the deeper structures.

On a fairly extensive search of the literature it seems that Shahan and Post were the first to seriously apply heat for the reduction of intraocular pressure. The only subconjunctival application of heat that I have found in literature expressly for the purpose of reducing intraocular pressure is that of Preziosi.[1] He uses the electric cautery preceded by the splitting of the cornea with a keratome in order to produce a fistulous opening under the conjunctiva and thus produce the effects of an Elliot operation without the danger of infection and with a lessened danger of intraocular hemorrhage. He states that the cautery puncture into the anterior chamber is more easily done than the trephine.

It was decided that an attempt would be made in some selected cases to destroy the sclera over the ciliary body under the conjunctiva and also by slow cautery destroy part of the ciliary body so that it would not create so much aqueous and also produce from the posterior chamber a filtering area. In the earlier experiments the least possible was done on account of the fear of injury to the lens and other structures. It was soon found that these could not be well injured.

OPERATION.—Two drops of a 5% solution of cocaine is instilled into the conjunctival sac every five minutes for fifteen minutes, then 8 minims of a 1% solution of cocaine is

[1] Preziosi, Contini Luigi. "Electro-cautery in treatment of glaucoma." *Brit. J. Ophth.*, 1924, Sept. 8: 414–417 (Abs.). *Int. Surv. Ophth.*, 1924, 8: 4: 223.

injected deeply under Tenon's capsule over the place selected for the operation, which is always in the upper part of the eye. After waiting for five minutes a horizontal incision is made through the conjunctival and subconjunctival tissue. This incision is about 15 to 20*mm* long and about 10*mm* above the cornea. The conjunctiva and loose subconjunctival tissue is dissected down as far as the line of firm union with the cornea but not beyond this. No splitting of the cornea therefore takes place. The flap is laid back over the cornea and the bare sclera is in view. If there are any bleeding points, light cauterization stops them and we work on a clean dry surface. Two *mm* behind the corneal tissue an area over the ciliary body is selected for cauterization. This area should have a diameter of about 6 or 8*mm* extending upward in the sclera; its horizontal diameter may be as much as 10*mm* depending on the amount of pressure in the eye. An electric cautery with a wire not wider than 1½*mm* is used and this is heated to redness and allowed to cool to a black heat before applying to the area selected. If the thickness of the platinum wire is about 2*mm* the point should be kept away from the eye for about two seconds before touching the sclera. If the wire is thinner there should be no interval between the first appearance of black heat and the touching of sclera. The point is allowed to touch the sclera and remain for about 10 seconds, and this is repeated until the whole area is gone over. It is important that the cautery should not act too quickly, excepting when a decompression staphyloma is desired. There should be no visible burning through the sclera and therefore no actual entry of the superciliary space or of the anterior chamber, especially in cases of prolonged very high intraocular pressure. There should be a complete destruction of the sclera and some destruction of the deeper tissues without actual entry to the anterior chamber or the posterior chamber. No attempt is made to remove the charred tissue as it helps to hold back any sudden rush of aqueous. If the sclera is sufficiently burned there may be points which on absorption of the damaged tissue act as filtering spaces, thus adding the benefit of filtration. The conjunctiva is sutured as in an Elliot operation. The intraocular pressure will be the same immediately after the

operation as before but it comes down during the following 24 hours and more during the days following if there has been sufficient penetration of heat by conduction. Should the intraocular pressure be less immediately after the operation it is proof that there is some seepage of aqueous. If this is gradual and not sudden it is an advantage. When it occurs at a single point before we have finished cauterizing the whole area selected it may make the completion of the operation more difficult as the point will cool before the heat is conducted deep enough. In some cases there is some pain after the operation for fifteen or twenty hours, and an order should be left for ½ grain of codeine by hypo.

WHAT ARE THE POSSIBLE DANGERS OF SUCH AN OPERATION.—1. If too much heat were used for a long period there may be a danger of producing cataract. (This risk was knowingly taken in one of the series of these cases in which a senile cataract was progressing rapidly in a diabetic patient, on account of the fact that the tension was refractory to other methods excepting sclerectomy, which was considered unsafe in this case.)

2. If there is anything in the theory that the absorption of uveal tissue is likely to create an antibody against uveal tissue which *would act* upon the other eye and produce sympathetic ophthalmia it may be possible that partly destroyed uveal tissue may be absorbed and produce such an effect. I am not afraid of it. My cases were observed carefully with this point in view.

3. If the eye is not well under local anæsthetic a sudden movement of the eye may produce a corneal scar. I have never had any trouble in controlling the eye under a local anæsthetic when injected under Tenon's capsule five or ten minutes before the operation.

It is conceivable, although I do not know it as a fact, and it has not happened to any of my cases, that cauterization of the sclera of the ciliary region may cause an accumulation of fluid under the choroid which may be more extensive than is desirable, causing a large separation of the choroid analogous with a blister from a burn on the skin. We are beginning an investigation on this and other questions regarding the changes which take place, on animals at the Medical School at the

University of Kansas and may be able to say more about it in the future.

I shall now give a brief outline of twelve cases on which the experiment was made on 16 eyes, all under high pressure for a long time and with little or no vision. I am aware that sufficient time has not elapsed for us to judge of its permanence; but the cases on which it was tried were extreme cases and refractory to other methods for temporary relief and for this reason the somewhat precipitate preliminary report I think justifies itself.

CASE NO. 1.—J. E. A. Male. Aged 69. First seen five years ago at the Clinic of the University of Kansas. Both lenses clear, vitreous clear. Vision right eye, could distinguish where windows and doors were. Left eye, slight light perception in periphery of field temporal side. He gave a history of rapidly failing vision although on measurements at various times in our Clinic the tension was never found to be above 55*mm* (MacLean Tonometer). His anterior chamber was almost normal in depth and yet with repeated iridotomies (3) he kept the tension about from 35 to 42, for three years. After that it began to go as high as 60 or 70 in each eye and adrenalin helped to keep it usually about 42 so that today his vision is about the same as it was 5 years ago. Myotics never helped. On Oct. 20, 1924, after omitting all drops for three weeks his tension in the right eye went up to 60*mm*. An experimental operation was done as described above and when seen Nov. 28, 1924, the tension was 23*mm*. On Jan. 2, 1925, the tension in the right eye was 34*mm*. On Feb. 3, 1925, it was 47*mm*. There was no filtration. A similar operation was done on the left eye in December, 1924, with about the same results. This will probably have to be done again.

CASE NO. 2.—P. P. Female. Aged 65. Right eye lost 10 years ago from iridectomy operation. When seen at the Clinic at the University of Kansas, Oct. 1, 1924, as a return case the tension in the left eye was 70*mm* (MacLean Tonometer). The patient had had an iridectomy and cataract operation two years before by some other doctor. I had done an Elliot operation six months previously at Kansas University Clinic which with the aid of myotics kept down the tension until three weeks ago. Vision: light perception in the peripheral temporal field poor, no central vision. Field other places blind. She said she had but little more vision than this for two years. Exam-

ination showed steamy cornea, there was a flat nonfiltering scar over the Elliot operation which when seen two months previously had been raised up and showed filtration. On Oct. 10, 1924, after vainly trying to reduce the tension with myotics and general treatment the tension remained about 65*mm*. It has been my experience that a sclerectomy in glaucoma following cataract extraction does not give permanent results and I was unwilling to subject this only eye to the further risk of hemorrhage. Therefore the operation above described was done, except that the cautery began partly over the edge of the cornea and extended over about 3*mm* in the sclera. The area cauterized was about 3*mm* in diameter. The intraocular pressure fell as low as 18*mm* during the following three days and remained low for five weeks but when seen on Dec. 1, 1924, it was 42*mm*. The vision had increased to hand movements in reflected light; much better than previously. The patient was again seen on Feb. 3, 1925, and the intraocular pressure was 49*mm*. There was no filtration. I shall do a more extensive cautery and try to produce a filtering scar.

Case No. 3.—W. W. Male. Aged 73. Absolute glaucoma. Elliot sclerectomy five years previously on both eyes. Successful on right eye. Had no light perception in left eye at that time. Lately eye uncomfortable. Intraocular pressure 65*mm*. Oct. 28, 1924, light scleral cautery on nasal side of former trephine operation. Eye comfortable since and intraocular pressure never above 35*mm*. No filtration seen. No trace of any scleral cautery having been done. Discharged from hospital Jan. 20, 1925.

Case No. 4.—C. E. M. Male. Aged 65. Chronic glaucoma both eyes. Normal anterior chamber. Intraocular pressure, R. 65, L. 70, on Sept. 30, 1924. Iridotomy failed previously in both eyes as also did sclerectomy (Elliot) on right eye. Scleral cautery right eye fairly deep and slow on Sept. 30, 1924. For about three weeks the intraocular pressure ranged from 15 to 30*mm* and after that intraocular pressure was from 35 to 40*mm* till last seen on Jan. 8, 1925, when it was 35*mm*. No local treatment since operation. There is a small raised spongy filtering area.

Oct. 20, 1924, scleral cautery left eye. Oct. 28th, intraocular pressure 20*mm*. It ranged from 20 to 34 until Jan. 8th, and it was then 25*mm* and when last seen it was 25*mm*. In each of these eyes we find a late appearance of filtering

raised-up area over the cautery, although no entrance to the anterior chamber was made by the subconjunctival cautery which was slow and deep in these two eyes but not so extensive as might be made in future.

CASE No. 5.—C. A. W. Female. Aged 63. Acute glaucoma right eye. Intraocular pressure 90*mm*. Had been high for over 4 years. Pupil dilated, cornea steamy, shallow anterior chamber. Periphery of iris adherent to cornea. Two peripheral iridotomies reduced the intraocular pressure from 53 to 40*mm*. Sept. 27th, a subconjunctival cautery was done and since that time the intraocular pressure ranged from 19 to 28*mm*. The patient was last seen on Feb. 3, 1925, when the intraocular pressure was 22*mm* and the vision was $\frac{10}{100}$, the original vision being $\frac{10}{200}$, before the cauterization.

In this case there is a wide area showing that there is filtration, but before this appeared the intraocular pressure was lower than later. This showed that besides filtration there is also in the early stage of the cautery a decrease of the fluid in the eye by damage to the ciliary body or its blood or nerve supply. This early relief of pressure, however it takes place, is of great benefit to the patient if only for temporary relief of the strain put on the optic nerve and retina.

CASE No. 6.—W. K. Female. Aged 68. Chronic primary glaucoma both eyes. Left eye absolute, right eye, light perception in extreme periphery of temporal side over an area of 15 degrees. Intraocular pressure, R. 90, L. 65. Dec. 19, 1924, subconjunctival scleral cautery right eye. This cautery was slow and deep. Intraocular pressure has remained low since, and when last seen Feb. 10, 1925, it was 26*mm* and visual field was extended over an area of 30 degrees in the periphery. Objects seen when walking. Patient was elated with success in vision. She had no central vision of course. Left eye, Jan. 20, 1925, cautery. Lighter than before. Intraocular pressure 50*mm*. On Feb. 1st, and when last seen on Feb. 10th, the intraocular pressure was 34*mm*.

CASE No. 7.—D. B. H. Male. Aged 69. Acute absolute glaucoma, right eye. Chronic glaucoma, left eye. Vision, R. no light, L. $\frac{5}{6}$ 2 letters, without correction. Intraocular pressure, R. 100, L. 50.

Right eye:—Anterior chamber about normal, eyeball inflamed, steamy cornea. Eye painful. Had been ad-

vised to have this eye removed. Iridotomy reduced the intraocular pressure to from 70 to 80*mm* for six months and the eye was comfortable. On Dec. 19, 1924, scleral cautery done lightly. Intraocular pressure reduced to 60*mm*. Eye comfortable and quiet since and intraocular pressure 60*mm*. No filtering area observed. A more extensive cautery would probably have done better.

CASE No. 8.—S. C. Male. Aged 24. Retinal detachment. Glaucoma. Intraocular pressure on Nov. 1, 1924, when operated on by subconjunctival scleral cautery, was 80*mm*. Although this was only a superficial burning probably not destroying the sclera through to the ciliary body, the intraocular pressure fell next day to 30*mm* and remained at that till Jan. 2, 1925, when it was 65*mm*. Three days later a knife cautery was used after laying back the conjunctiva and a cautery incision was made 6*mm* long and 4*mm* from the limbus and running from the former area. The choroid was exposed and could be seen to bulge slightly. The conjunctiva was replaced. The intraocular pressure has since remained from 38 to 50*mm* up to Feb. 5th, and there is a small growing staphyloma. There is no filtration.

On Feb. 9th, the staphyloma is larger and the intraocular pressure is 68*mm*. There is no filtration. The vision is decreased; and it is clear that the mere formation of a decompression in the form of a staphyloma is disappointing as far as reducing intraocular pressure is concerned, if done in the way in which I have done it. It may be successful if more area were destroyed in the sclera especially in a person at the age of 24. Less may help in younger patients.

CASE No. 9.—W. S. B. Male. Aged 52. Absolute glaucoma, left eye. Large pupil, deep anterior chamber. Intraocular pressure 80*mm* when not under treatment. Oct. 14, 1924, a slow scleral cautery was done on the left eye, and on Oct. 19th, the intraocular pressure was 19*mm*. Jan. 31, 1925, intraocular pressure was 31*mm*. Flat filtering area with no invasion or lifting up of corneal tissue. Patient is seeing light in the temporal periphery, although on Oct. 14, 1924, he could not see light in any part of the field. Patient was again seen on Feb. 27th, when the intraocular pressure was 38*mm*.

CASE No. 10.—D. W. Female. Aged 54. Chronic glaucoma. Intraocular pressure, R. 90, L. 90, without treatment. Vision: R. hand movements, L. $\frac{14}{100}$. Oct. 23, 1924, scleral cautery right eye pressure fell to 23*mm*.

Vision increased to $\frac{15}{100}$ and has remained the same ever since. Nov. 11, 1924, scleral cautery left eye pressure fell to 25*mm*. Slow burning and intraocular pressure remains from 38 to 54*mm* and when seen on Jan. 31, 1925, was 39.

When seen on Feb. 3rd, intraocular pressure was R. 57, L. 54. Vision failing. No filtration. Vision was $\frac{1}{10}$ 3 letters. No local treatment since operation in each eye, excepting three weeks of atropin in the right eye immediately after the operation. This patient was very nervous and I could not do as extensive cautery as I had intended.

CASE NO. 11.—J. M. C. Male. Aged 65. Absolute glaucoma, right eye. Intraocular pressure, 90*mm*, anterior chamber deep, cornea steamy, patient in great pain. Left eye, intraocular pressure was 70. Vision: L. $\frac{10}{100}$. Oct. 29th, iridotomy on left eye which leaves the intraocular pressure in this eye, on Feb. 3, 1925, at 37*mm*. On the same day a deep quick subconjunctival cautery was done on the right eye. Steaminess of cornea disappeared on the operating table and the intraocular pressure felt less but in an hour afterwards he was suffering from great pain and the cornea was again steamy. The pain was relieved with $\frac{1}{2}$ grain of codeine by hypo. The next day the intraocular pressure was high, but not so high as before the operation, and the steaminess of the cornea had disappeared.

On Feb. 3, 1925, when last seen the intraocular pressure was 60*mm* and the eye was comfortable. On account of the great pain in the right eye this patient had been advised, previous to seeing me, to have the eye removed by reputable and careful eye specialists. It is, at least for a time, doing better service than an artificial eye.

CASE NO. 12.—W. V. L. Female. Aged 64. Chronic primary glaucoma. Absolute. Left eye had an iridectomy done 5 years ago. Dec. 6, 1924, the intraocular pressure was 60*mm*. Dec. 8, 1924, subconjunctival cautery. Sudden loss of a little aqueous. Intraocular pressure was not reduced. Intraocular hemorrhage. Eye painful for 2 weeks and when last seen Feb. 28, 1925, intraocular pressure was 70*mm*. No filtering scar. Area flat.

SUMMARY.

In these 16 experiments there are 5 eyes in which the good results appear to be permanent. The pressure has remained low for three months and in each there seems to be good filtration through a somewhat spongy raised area over the

place of cauterization. It appears that there were two factors helping to reduce the intraocular pressure in these cases. One filtration and the other the interference with the function of part of the ciliary body.

In 7 of the experiments there was a fall of pressure lasting over 7 weeks with a tendency to rise again. It is notable that in these cases there is no filtration and the scars are flat. Probably the factor of interference with the function of part of the ciliary body plays the part in the reduction of pressure here. In one experiment there was a rather sudden loss of aqueous and this was followed by an intraocular hemorrhage and the eye was worse than before. In two cases there was no improvement. In the remaining case there was a small staphyloma formed which with the injury to the ciliary body kept the intraocular pressure down for nearly three months. It is returning again.

In the future development of this procedure we must determine what size of area should be cauterized and how far the heat should penetrate.

There are three factors which could be used in reduction of intraocular pressure through subconjunctival cauterization:

1. Filtration.
2. Interference with the function of part of the ciliary body.
3. Production of a decompression staphyloma.

Only further experiments can teach us how much each or all of these factors may be utilized.

THE USE OF THE TENDON TUCKER—A METHOD OF SUTURING WITH SILK.

By Dr. FRANK E. BURCH, Miller Clinic, St. Paul, Minn.

(With two illustrations in the text.)

THE principal advantage of the tucking operations for strabismus and heterophoria lies in their safety and simplicity. The preservation of the original insertion of the tendon thereby lessening the risk of producing vertical deviation is a decided advantage. Not so very infrequently, one sees a cyclophoria, hyperphoria or hypophoria following an advancement or resection operation which in many cases may be attributed to faulty suturing or to one or more sutures slipping or pulling out. Rarely, one also sees patients in whom, because of sutures becoming loosened, insufficient correction of the original strabismus has followed or the deviation has been actually increased by operation.

By the use of the tendon tucker which clamps the base of the folded muscle in close apposition to the natural tendon insertion until the sutures are firmly secured, one minimizes the possibility of introducing new muscle deviations or loosing the effect gained because of sutures pulling out.

The arguments against muscle folding operations have been, the undue stretching of the muscle and tendon when correction of high degrees of strabismus is attempted, and the use of catgut sutures. There can be little doubt the two reasons just given have discouraged the extended use of tucking methods. The unsightly hump which follows the use of 30 day catgut sutures, which if they serve the purpose intended must be slow of absorption, has been a further reason for some to revert to older, or to adopt newer procedures.

While it is quite true that muscle tucking is not so easily

performed in very high strabismus as is the Reese resection the various advancement operations or the more recent Jameson recession operation, I have found correction of very high deviations possible by folding the muscle without the use of any tucking or folding device. Lagleze, Suffa, Bannister, Woodruff and others have demonstrated that this is possible. However, it has been my personal experience that when no instrument other than muscle forceps or a strabismus hook is used, it is difficult to accurately place the sutures and that very considerable irregular puckering of the muscle results after tying the stitches. Therefore, I have come to the conclusion that for extremely high cases of strabismus, when the use of the tucking instrument involves extreme stretching of the muscle and tendon, it is better to abandon the tucker for advancement or resection methods. Convergence of thirty degrees and divergence of twenty-five degrees represents about the maximum correction possible with ease and even for these degrees of lateral deviation a partial tenotomy, cutting all the central fibres of the opposing muscle, enhances the effect and should be done.

In the Archives for July, 1922, the writer described a muscle tucker and a method of suturing which had been used with success. Many favorable comments and a number of helpful criticisms of the instrument have been offered by ophthalmologists interested in muscle shortening. As a result of these suggestions and after trying out various modifications, the blades of the tucker have been broadened, flattened, and their edges rounded. By increasing the width, there is no tendency to slip sideways while being drawn up on the hook before clamping. After the desired amount of shortening has been made and the ring clamp applied, they simply cannot slip. By flattening the blades as much as possible, more space is provided for inserting sutures beneath the instrument and this is a distinct help, especially in shortening the Internal Rectus. By rounding the edge of the blades, the chief objectionable feature of all tucking instruments is minimized; vis, stretching of the muscle when much traction is required for correction of high errors.

For two years past, the technic of our tucking operations has been slightly modified to obviate the use of catgut. It

is believed that the danger of infection is lessened by the use of removable silk sutures instead of the buried catgut previously employed. We have definitely proven that the reaction is much less and the period of persistence of the hump resulting from the tuck is much shorter. After turning the eye well to the opposite side, a vertically curved conjunctival incision is made lateral to and well away from the tendon insertion, about midway between its insertion and the caruncle, external canthus or lower culdesac. The conjunctiva is dissected up *only so far as the tendon insertion*, but not beyond it. The muscle is freed of conjunctiva back to the canthus and freely exposed. Three round, half-curved needles

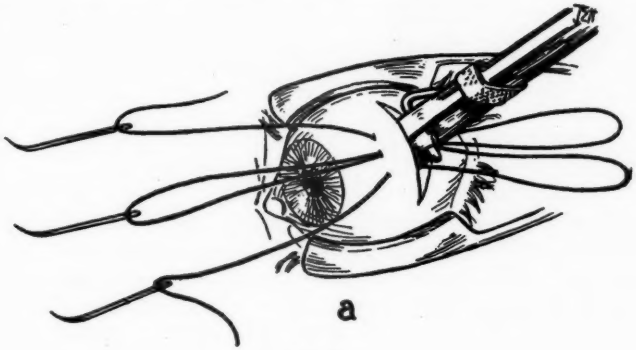

FIG. 1.

with lateral eyes, are threaded upon a single No. 4 braided silk suture, sixteen inches long, the middle needle midway upon, the others near the ends of, the suture. Having placed the tucker beneath the tendon, secured the desired amount of shortening and clamped the blades firmly, the middle needle is inserted through the exact centre of the tendon *from the side away from the cornea*. Passing beneath the blades of the tucker and the tendon insertion, it also is passed directly through the overlying conjunctiva. The two end needles are similarly passed through the upper and lower edges of the base of the tuck and tendon insertion and on through the conjunctiva about 3*mm* space above and below the point penetrated by the first needle (Fig. 1). The two loops remaining

after the needles are cut off, are securely tied *over* the conjunctiva. After firmly knotting the sutures, the hook of the instrument is released, the ring clamp freed and the tucker removed. The tuck in the muscle and tendon is flattened down toward the canthus, beneath the conjunctiva which is then closed (Fig. 2). For closing the conjunctiva with fine

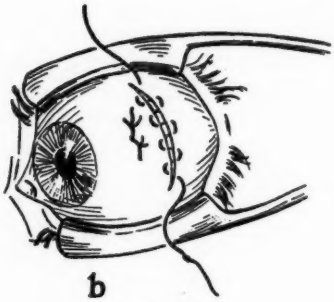

FIG. 2.

twisted silk, the "water-tight" running suture suggested by R. Foster Moore after trephining for glaucoma has been used, leaving a knot several *mm* from the origin of the suture, but leaving the remaining end untied free in the culdesac. Thus, by grasping the knotted end with forceps, its removal after four or five days is painless and easy. The two main sutures are not removed until the 10th day.

Practically the above technic has been used by us in all tucking operations for almost two years without variation and it has proved exceedingly simple and satisfactory, especially in the correction of moderate degrees of heterotropia, for high heterophorias, and for the correction of alternating squints with the double operation. Above all methods which seek to embrace safety and accuracy with simplicity, the use of the tucker which firmly holds the shortened muscle and securely clamps the tendon while the sutures are placed and tied as described above has proven of very great help in obtaining good end results in the above types of muscle deviation.

MISCELLANEOUS NOTES ON GLAUCOMA.[1]

By Dr. HAROLD GIFFORD, Omaha.

THESE odds and ends from my glaucoma experience are offered in the hope that, while they may convey nothing entirely new to the majority of ophthalmologists, some of the ideas and facts may not yet be common property.

DANGER OF MISTAKING CHRONIC GLAUCOMA FOR CATARACT.

This danger is fully recognized by ophthalmologists, but, in view of the comparative frequency of the acute and chronic forms, it receives in current textbooks by no means the consideration that its importance demands. The danger of mistaking acute glaucoma for iritis is generally mentioned with some emphasis, while the danger of overlooking the existence of the chronic form receives no more, and, generally, not so much attention.

In looking over my files for the last two years, I find that the number of patients who have had the sight of one or both eyes seriously injured by neglect of chronic glaucoma is at least five times greater than of those who have been injured by acute glaucoma. It follows that, for teachers of ophthalmology and for authors who are writing for the general profession, the danger of misinterpreting the chronic form should receive decidedly more attention than the acute. Nor is it strictly true, as at least one eminent authority states, that it is hardly conceivable that a trained ophthalmologist could make this mistake. When chronic glaucoma is complicated by well marked incipient cataract, so that the examination of the disk is difficult or impossible, the mistake is not easy

[1] Presented before Section on Ophthalmology of the American Medical Association, Chicago Session, June, 1924.

to avoid, unless the ophthalmologist, as a routine in such cases, beside examining the fundus with a dilated pupil, tests the tension and the field; and while I do not pretend to have invariably followed this rule, I have seen enough mistakes of this sort by practicing ophthalmologists, including myself, to strengthen my resolve to follow it in the future.

GLAUCOMA FROM CATARACT DISINTEGRATION.

In the later stages of cataract devolution, one may encounter another form of glaucoma that may easily be overlooked. I refer to the form that results from spontaneous disintegration of the lens. When the accompanying reaction is violent, as in some cases of "spontaneous cure of cataract," there is little danger of overlooking the glaucoma, although it is generally misinterpreted as the cause, instead of the effect, of the absorption of the cataract. But in the earlier stages of this process there occurs a quiet glaucoma which sometimes leads to a serious mistake in prognosis. Such an eye presents a normal exterior with a hypermature cataract, with such poor light-sense and projection that any operation for the cataract seems to be entirely unjustifiable. Testing the tension is either not thought of or, if a moderate rise is found, it is attributed to a rigid sclera. If the patient lives long enough, such a cataract probably always ends in a "spontaneous cure"; but, in the meanwhile, either with or without violent symptoms, the sight, in a large proportion of cases, is entirely lost. In others, the high tension disappears, at least temporarily, with the complete absorption of the disintegrated lens-cortex, and the eye recovers useful sight without an operation; in still others, the tension declines with the absorption of a comparatively small part of the cortex, and the ophthalmologist is agreeably surprised, on seeing the patient again, to find the projection good; and he concludes that there was some unaccountable mistake in the first examination. Or he is surprised, but not agreeably, to find that the patient has been to some one else and has had the cataract removed with a first rate result.

It follows, of course, that the cure for this kind of glaucoma, though it may come too late to save the sight, is the removal of the lens.

SOME POINTS IN THE TECHNIC OF TREPHINING AND IRIDOTASIS.

One reason for the hesitation that many operators exhibit toward recommending one of the fistulizing operations is the slight sense of uncertainty that is often felt as to just how the operation will pan out; and this feeling by no means disappears even after quite an extensive experience. The first trephining that I did went through absolutely according to schedule, but I have had many others that did not go so smoothly. With regard to trephining, the operator, by following minutely the instructions given by Elliot in his invaluable Treatise on Glaucoma, can almost certainly obtain a good operative result. Some men, however, find it hard to follow instructions minutely, and occasionally get caught with a poor trephine, with the result that the instrument, even if applied far enough forward at first, slips and makes the cut too far back; or by cutting slowly it makes the operator too cautious; and the frequent raising of the trephine, to see whether it is through, leads to cutting through so small a portion of the ring that the aqueous escapes before there is room for the iris to prolapse. Careful inspection with a magnifier ought to reveal any defect in the cutting edge, and if there is the slightest doubt on this point the blade should be rejected without hesitation.

In following Elliot's advice to leave a hinge at the hind part of the disk, it is well, I find, in order to avoid the tendency for the blade to slip backward, to bear down evenly at first so as to make a good round groove before beginning to bear down harder in front.

Fixation by the superior rectus tendon with rather heavy forceps with projecting teeth, two on one blade and one on the other, with a sliding catch, greatly facilitates the operation. It is left on until the stitches are put in. The conjunctiva is pulled down one-eighth inch or so with fine forceps before applying the heavier forceps. This is to give plenty of membrane for the flap and to allow the latter to be cut thick enough at the summit to permit it to be pulled forward freely with toothed forceps, without danger of lacerating it. This gives an advantage both in applying the trephine and in watching the pupil for the first sign of penetration. In

cutting the flap, I generally find it unnecessary to split the cornea. If the dissection is carried to the extreme limit of the limbus and the flap is held away from the globe at an angle of nearly 90 degrees, one can place the edge of the trephine right up to the line of attachment; and, *if it is kept there*, the opening into the chamber will be plenty far enough forward where the operation is made above, though, when the trephining is made below the cornea, splitting may be required.

I prefer the heavy-handled Elliot trephine. I have never tried the mechanically driven instruments, but I cannot see how they can be controlled as well as the hand-driven ones.

When having cut deep enough and turned down the flap the iris is seen pushing up the hinged disk, Elliot advises cutting off disk and iris with one stroke of the scissors. This cuts an unnecessarily large hole in the iris. It seems to me that the iris is more apt to retract into the chamber promptly and completely (physostigmin [eserin] having been used freely fifteen minutes before beginning the cocain) if the summit of the prolapse is cut off by itself and the loose part of the disk later. I find that the best way to encourage the iris to return fully to the chamber is to give gentle pushes with the knee of a large strabismus hook, over the trephine hole and at each side of it.

In doing an iridotasis, the main difficulty is to be sure that the iris will stay out far enough; here the preliminary use of physostigmin is, of course, undesirable. To prevent the drawing back of the iris into the chamber I have tried using a little atropin before the operation, but have found this to be a mistake, as it sometimes widens the pupil so much that the narrow rim of iris can only with difficulty be drawn far enough out of the chamber. To check the tendency for the iris to be drawn back into the chamber, *I generally nick the pupil margin at one side.*

Although I do not think that I have ever injured a lens with a spade knife, the possibility of doing so is always present to one's mind, especially when the incision has to be started beneath a dissected-up, somewhat edematous and bloody conjunctival flap. I have therefore performed a number of iridotases with a rather narrow cataract knife, piercing the conjunctiva three-sixteenth inch outside the corneal margin,

carrying it beneath the conjunctival surface into the chamber; then, on making the counterpuncture, the progress of the knife is stopped as soon as it has entered the subconjunctival space on the opposite side. This allows a bleb to form in front of the point, within which the latter can be carried on approximately from one-eighth to three-sixteenth inch beneath the conjunctiva; then on cutting up it is comparatively easy to make the upper part of the conjunctival flap as wide as necessary. To cut the flap in this way with the greatest ease, it is best to inject a very small drop of 4 per cent. cocain solution at each side and above the margin of the cornea. I say a very small drop because, unless care is taken about this, the conjunctiva becomes too edematous, and the careful delimination of the flap is made much more difficult. A flap made in this way bleeds less than when it is dissected down from above; it also turns down so as to allow a better view of the incision than with the ordinary method. This method of making the flap and incision is, of course, practically the same as recommended by Lagrange for his sclerectomy.

COMPARISON OF THE RESULTS OF TREPHINING AND IRIDOTASIS.

With a well performed operation, I believe the ultimate results of trephining and iridotasis, so far as tension is concerned, are practically identical. Owing, however, to the slight uncertainty as to the exact position of the margin of the pupil, with reference to the scleral incision, in iridotasis, the final reduction of tension is sometimes not produced until a secondary subconjunctival puncture of the iris has been performed. In other respects I find the main difference between the two operations to be that the chamber is restored much more promptly, on the average, after iridotasis than after trephining. This shortens the period of anxiety that attends the long persistence of an empty chamber. To be sure, the chamber almost always fills up eventually, after trephining; but, knowing as one does that a persistent flat chamber, after a fistulizing operation, is apt to be followed by cataract formation, its early restoration is a reassuring sign. It is only fair to state, however, that I have seen persistent flat chamber *with secondary cataract*, in fully as large a per-

centage after iridotasis as after trephining. Possibly on account of this earlier restoration of the chamber, detachment of the choroid has been decidedly less common in my iridotasis cases than in the trephinings. Estimates as to the frequency of detachment of the choroid after trephining vary greatly. Schur found 3.5 per cent., while Hagen, by using a special method of transillumination, reports that it occurs in something over 60 per cent.; and while my own percentage is much lower than this (about 20, possibly because I have never been able to make a success of Hagen's transillumination method of diagnosis), I feel quite sure that the number of detachments after all kinds of fistulizing operations is generally much underestimated, on account of the ease with which they are overlooked. Occurring, as they do, almost always at the nasal or temporal side, one is very apt to miss them if, on looking into the eye, the patient is made to look first straight ahead and then to each side. Examined in this way, one may look straight at a large choroidal detachment, and because it gives back a dull red reflex, may conclude that this is the ordinary fundus-reflex somewhat dimmed by peripheral opacities in the lens or vitreous. But if, instead of having the patient turn his eye from side to side, the observer will very slowly move his own head so as to carry the light gradually around from the center to the periphery of the fundus, he will more easily recognize the dark convex margin of the detachment, which is missed when the patient moves his own eye more rapidly. This may seem like a mistake which none but a tyro could make; yet I am certain that I made it many times before I came to realize the possibility of making it; and in demonstrating this possibility to my colleagues and assistants I have seen them repeatedly overlook detachments, after having been assured by me that they were present. Choroidal detachments, of course, nearly always replace themselves, but I have seen at least one case in which a large, double-sided detachment remained unchanged, with a corresponding limitation of the field, for several months; as long, in fact, as the patient could be kept under observation.

As to the danger of leaving iris out of the chamber under the conjunctiva, I can sympathize with the prejudice, against any such procedure, which Elliot expresses. At first thought

it seems like deliberately courting trouble. Practically, however, I am convinced that the danger of infection of iris-tissue well covered by smooth conjunctiva is negligible. When covered by the roughish distended conjunctiva of an iridotasis bleb, the danger is, of course, greater, but little if any more so than that of infection of the iris just inside a trephine hole. Where a late infection penetrates to the interior of a bleb, the eye is almost always lost anyway.

In sixty-two iridotases I have had one primary infection with serious loss of sight (doubtless from too much handling of the iris in the presence of a congested conjunctiva); something which I have never had in 231 trephinings. I have also had one inexplicable case in which, within a few days after the iridotasis, the deeper layers of the cornea became so peculiarly opaque as to simulate a swollen traumatic cataract. This nearly all cleared up, but a trephining was necessary later and the final result is not yet. Iridotasis seems simpler than trephining, and is certainly an efficient way of fistulizing an eye. I am not sure that it is as good or as safe as Elliot's trephining.

With the Lagrange operation or with cyclodialysis I have had very little experience.

In my first report on Curran's peripheral iridotomy I predicted a great future for it *if the favorable results obtained in the first year of trying it proved to be permanent.* My second report indicates that while, in a certain proportion, the good results are permanent, in most cases the high tension returns. Where after any of these operations, the tension tends to go too high, the liberal use of eserine and massage will sometimes obviate a second operation.

THEORY OF MODE OF ACTION OF IRIDOTASIS AND CYCLODIALYSIS.

Among the more or less successful glaucoma operations that have been based on faulty theories, one must place iridotasis and cyclodialysis in the front rank. Borthen, it will be remembered, in attempting to produce a Holth iridencleisis, pulled the iris out so far that it did not go back to the desired point; and as the result was unusually good, he erected the accident into a method and attempted to explain its

mode of action by the assumption that the stretching of the iris-root freed adhesions which were obstructing the outflow from the chamber. On first hearing of this operation, and ever since, it has seemed obvious to me that the operation, by drawing the margin of the pupil out past the external opening in the sclera, produced a fistual by covering one side of the wound with a membrane provided with an epithelial protective surface, to which the other side of the scleral wound could not adhere. All the various iris-inclusion operations probably act more or less efficiently in the same way.

If this is the true explanation of tension-reduction by iridotasis, it follows that, theoretically, the best way to perform the operation would be, after drawing the iris out, to make a radial cut in it at each side so that the piece included between these cuts could be turned out like an apron. I found, however, that this performance was not easily done. The double cut mangled the small bit of iris too much. So I have contented myself, as indicated above, with making a single cut through the sphincter at one side of the drawn out iris. This permits the iris to be turned inside out, and checks any tendency for it to be drawn back into the chamber.

Similarly, the cyclodialysis of Heine was devised in the pious hope that a tunnel, burrowed through between the choroid and the sclera into the anterior chamber, would kindly refuse to close. Although the assumption was inherently improbable, and was shown to be wrong, so far as it could be tested by animal experiments, the operation nevertheless has proved to work well in certain cases, because it produces atrophy of some of the ciliary processes, with consequent decrease in the production of the intra-ocular fluid.

BUPHTHALMOS.

Although entirely different from most forms of glaucoma in its origin, buphthalmos nevertheless would seem, *a priori*, to be an ideal field for the use of trephining. The abnormal breadth of the limbus makes the production of a subconjunctival trephine hole into the chamber exceedingly simple, and the immediate results on the tension are all that could be desired. To my surprise, however, I found, on using it in

two cases, that the tension rose rather quickly to the original point; and, although a number of good results from its use in this condition have been reported, a surprisingly large number of observers, beside myself, have obtained mediocre or poor results. To explain this disappointing experience, I have advanced the theory that, on account of the stretching of the anterior segment of the globe, the conjunctiva is drawn so tightly over the surface as to favor a solid attachment of the membrane to the margin of the trephine-hole; a theory for which I have no undue affection, although I know of none which seems better.

A reliable method of treating buphthalmos remains to be found. I have had one perfect result from a subconjunctival anterior sclerotomy with the production of a moderate subconjunctival prolapse. In other cases, such a prolapse has failed to reduce permanently the tension until the prolapse has had a subconjunctival double puncture. This treatment of the prolapse has apparently cured two cases, but they have not been followed long enough to be certain that the results will be permanent. In the only case in which I have seen iridotasis tried in buphthalmos, the immediate result was good, but the prolapsed iris assumed a cystic form and the high tension returned. This was again reduced, apparently permanently, by a subconjunctival prolapse-puncture.

I am quite sure, from a disastrous personal experience, that an ordinary iridectomy is very dangerous in buphthalmos. Another thing that I have learned about this condition is that when the disease has persisted up to the age of 9 or 10 years with slowly but steadily decreasing vision, it is very dangerous to do any operation that evacuates the chamber completely, on account of the tendency to destructive intraocular hemorrhage or retinal detachment. In this stage, when the patient has very little sight and it is quite certain that this remnant will be lost if nothing is done, the temptation is great to attempt to preserve it; but if any such attempt is made, the operator should try to limit the loss of intraocular fluid as closely as possible; doing perhaps a small subconjunctival puncture; and he should do no operation except with the distinct understanding that there would be great danger of causing complete and sudden blindness.

GLAUCOMA FROM TRAUMATIC DISLOCATION OF THE LENS.

When the lens is dislocated forward, the explanation that the increased tension is due to blocking of the outlets of the chamber seems plain enough; but when, as in the majority of cases, the chamber is of normal or increased depth, some other explanation must be sought. That in these cases the high pressure is due to an intrusion of vitreous into the chamber is perhaps the most commonly accepted theory, and in support of this, I have found, on trephining three such eyes, that the vitreous crowded the iris into the trephine hole and continued to form quite a large bleb, beneath the replaced conjunctiva, which persisted for a month or more.

REMOVAL OF CATARACT FROM EYES THAT HAVE BEEN FISTULIZED FOR GLAUCOMA.

When an eye in which a trephining or some other fistulizing operation has been done with a good result on the glaucoma develops a cataract, the operator is placed in a somewhat embarrassing dilemma. Shall he operate in the ordinary way and thus perhaps bring back the glaucoma by destroying the fistula, or what? In one of my patients a double trephining had been done successfully, that is, so far as the relief of increased tension was concerned; but in both eyes the chamber was never restored, and, in the course of a year, cataract formed in both eyes. I operated for the cataracts by a corneal incision coming close to, but not disturbing, the trephine bleb. In one eye a good result was obtained; the glaucoma did not return, and useful sight was restored. In the other eye the glaucoma did not return, but the wound became infected, and most of the cornea was left hazy. From another patient with an extra large overhanging trephine-bleb, I attempted to remove the cataract by a similar corneal incision. The knife, however, entered the bleb at its lowest point; and, although the opening into it was very small, the bleb flattened down and has not been restored in the ensuing three years. The conjunctiva, however, although perfectly smooth, shows decidedly more pitting on pressure than is normal, and the tension, which, after the cataract operation, rose from 7 to 17, gradually declined, under mas-

sage, to the former stage, and it has remained stationary at this point.

My conclusion is that it is better not to risk spoiling an efficient fistula by making a cataract incision through the bleb. If another case of this kind should present itself, instead of making an upward corneal incision, I will make the incision downward and protect it by a sliding flap.[1]

SUBCONJUNCTIVAL PROLAPSE-PUNCTURE.

The subconjunctival prolapse-puncture mentioned in the foregoing is made as follows: Four per cent. cocain is injected so as to puff up the conjunctiva for at least three-sixteenths inch at each side of the prolapse; then a very narrow baby-cataract knife, or a straight knife-needle, is passed into one margin of the conjunctival bleb, then through the prolapse, and on into the edematous space beyond. I did this at first to flatten out the rare subconjunctival prolapses after cataract operations, on the assumption that a hole made in a bit of iris pushed out beneath the conjunctiva, probably would not close any more than a hole made in the iris in its normal position usually does. It worked so well that I extended its use to all glaucoma operations in which, with an unsatisfactory effect on the tension, a bit of iris remained ballooned out under the conjunctiva. In such cases, the effect of the puncture has almost always been good.

THE PROPHYLAXIS OF LATE INFECTION.

In reporting a case of late infection in 1914, I urged that all trephine patients be instructed to use a zinc chlorid collyrium[2]

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[1] A result similar to that obtained in the second case reported above is mentioned by Morax (*Ann. d'ocul.*, 1922, p. 187). An eye on which a successful trephining had been done developed a cataract, which was removed through a lateral incision entirely outside the trephine bleb. The latter nevertheless disappeared completely and permanently, although the tension remained low.

[2] Zinc chlorid, ½ grain (0.03 gm.); crystallized boric acid, 40 grains (2.6 gm.); water, 1 ounce (30 c.c.). This is not to be filtered. Many another solution would doubtless do as well or better. I have been experimenting with mercurochrome 1% lately. The point is to keep on with something indefinitely.

daily as long as they lived; and that, if in spite of this the operated eye should get sore, they should use the collyrium more freely and should at once begin the frequent use of hot applications and should report to a competent ophthalmologist without delay. Since then all my trephined (and iridotasisized) patients (representing more than 300 fistulizing operations) have been started on this plan; and I have seen only one serious late infection, in which the instructions were carried out. In two patients who kept up the zinc for two or three years without trouble and then stopped it, serious bleb infection occurred within two months afterward. In one of these, the eye was entirely lost; in the other, the infection was controlled with some difficulty. Vague reports of serious infection have also come to me concerning two other trephined patients living at a distance, but I have been unable to learn particulars, or whether instructions were followed. Two other patients with a trephine-bleb and an iridotasis-bleb, respectively, have had slight bleb-irritation, easily controlled by applications of 50 per cent. trichloracetic acid.

PROPHYLACTIC BLEB-PROTECTION BY SLIDING FLAP.

In one of the patients mentioned above, the mild inflammation of the trephine-bleb surface recurred, so I tried an operation which I have had in mind for years. I applied liquid trichloracetic acid to the surface of the bleb and to a band of cornea about one-eighth inch wide below it. The surrounding conjunctiva was then cut loose and drawn over the bleb and the cauterized cornea, with two lateral stitches. It remained in position perfectly, and for the succeeding two months the patient has had no trouble either with inflammation or with return of tension.

COLOBOMA OF THE MESODERMAL LAYER OF THE IRIS.

By Dr. JONAS S. FRIEDENWALD, Baltimore.

(With one illustration on Text Plate XIV.)

TREACHER COLLINS (1) has reported a case of a bridge coloboma of the iris in which, slightly below the bridge, ectodermal layers of the iris were seen for a short distance not covered with normal connective tissue. Lottrop-Andersen (2) has described a case in which in a section of the upper temporal region of one iris the pigment layers were seen to be completely naked and free from mesodermal cover. To these two interesting cases we wish to add a third.

The patient, a white man of 39 years, consulted us recently on account of pain in his left eye. The immediate cause of his discomfort was an old trachoma with panus and a series of small corneal ulcers at the margin of the panus. In addition the eye showed a well-developed and typical coloboma. The pupil was egg-shaped, the point being downwards and extending to the limbus. Ophthalmoscopic examination showed no choroidal defect. The optic disc was normal. A few fine shreds of persistent pupillary membrane could be seen with corneal microscope. The patient's right eye, which was free from trachoma, appeared perfectly normal on superficial examination, but when carefully studied a defect in the stroma of the iris was discovered. The appearance is shown in the accompanying illustration. Extending from the pupil to the lower limbus there is an area in which the pigment layers of the iris are covered over only by a thin layer of connective tissue. Trabeculæ and crypts are absent over this area,—well developed in the rest of the iris. In the center a thin vertical pigmented line can be seen. The movements of the pupil are quite normal and symmetrical. No defect

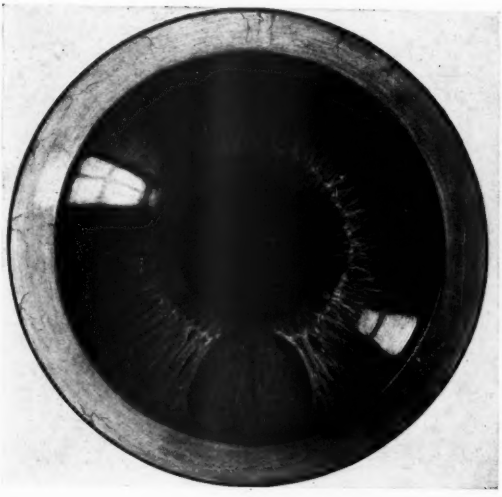
in the pigment layers of the iris could be demonstrated either by direct or transillumination. Examination with the corneal microscope showed no evidence of pre-existing inflammation. The cornea was clear. There were no deposits on its posterior surface. A few fine shreds of persistent pupillary membrane, similar to those seen in the other eye, were found attached to the normal, but not to the colobomatous area of this iris. The lens markings were completely normal. Examination of the fundus showed no coloboma of the choroid. The optic disk was normal.

DISCUSSION: The absence of evidences of inflammation and the symmetry of the defect in this eye when compared with the typical coloboma in the fellow eye, established beyond question the congenital nature of this defect. Two theories have been advanced to explain the development of coloboma. The older theory attributes the trouble to a failure in the closure of the cleft of the optic vesicle. It would be difficult to explain our present case on this basis, for it would appear that except for the development of the pigmented vertical line, the ectodermal layers show no defect.

The more modern theory (3) of the origin of coloboma deals with the possible persistence of the vascular connections which exist in the early embryo between the stroma of the iris and the hyaloid system on the back of the lens. According to this theory the persistence of these vessels inhibits the forward growth of the edge of the optic vesicle so that an indentation in this edge is developed. This theory is supported by the finding of tags of connective tissue in the apex of coloboma and is in accord with our knowledge concerning other congenital defects, for the persistence of foetal distribution of blood vessels such as the hyaloid artery or the pupillary membrane or the ductus arteriosus, is by no means a rare occurrence.

In order to reconcile this theory with the findings in our case, we may assume that a vessel of this sort connecting the stroma of the iris with the hyaloid system, persisted for some time during foetal life at a point corresponding in the adult to the lower limbus, but that the growth of the margin of the optic vesicle on either side of this vessel was sufficiently active to finally close in front of this vessel, resulting in the formation

ILLUSTRATING DR. JONAS S. FRIEDENWALD'S ARTICLE, "COLOBOMA OF THE MESODERMAL LAYER OF THE IRIS."



of a round pupil and the vertical pigmented stripe at the point where the two lips of the optic vesicle closed in. The ectodermal layers at this point would, however, be covered over only by a thin sheet of mesoderm, for the growth of the mesoderm would be blocked by the presence of the persistent communicating vessel.

This explanation seems to us a possible way of reconciling the findings in our case with the more acceptable theory of the development of coloboma. However, we admit that the case itself offers little evidence to support this theory. We have searched very diligently for a small localized defect in the pigment layers of the iris at the region of the root where the communicating vessel may be supposed to have persisted, but we have not been able to demonstrate such a defect. However, the absence of any such demonstrable defect is no evidence against our theory.

SUMMARY.

A case is reported presenting typical coloboma of the iris in one eye and a symmetrically located defect of the mesodermal layers of the iris in the other eye.

REFERENCES.

1. *Trans. Ophth. Soc.*, United Kingdom, 1906.
2. *Zentrabl f. d. ges. Ophth.*, vol. xiv., p. 348, 1925.
3. See MANN: *Trans. Ophth. Soc.*, United Kingdom, 1924, p. 161.

SYPHILITIC GUMMA OF THE EYELID.[1]

Case Reports.[2]

By Dr. EDWARD B. HECKEL and Dr. LAWRENCE G. BEINHAUER, Pittsburgh, Pa.

(With four illustrations on Text-Plate XV.)

"THE number of diagnostic difficulties, the different forms in which it is revealed, its generally slow progress, the prodigious efficiency of the treatment makes the syphilitic gumma a chapter interesting in the highest degree, of pathology of the eyelids," so quotes our distinguished colleague Narich (1) in his preamble to the highly enlightening work which he has undertaken.

AGE, SEX AND LOCATION.

In general, the gumma, being a lesion of acquired syphilis, is found, in adults usually between the ages of 30 and 50 years. Both sexes are attacked, but from the cases reported and views of others (2), the gumma is slightly more common in the female. Syphilitic gummatous infiltrations, are not however, strictly confined to the acquired form of syphilis, as cases are reported by Colucei (3), Wedl (4), Fordyce (5) and others, who have described syphilitic gummatous infiltrations of the eyelids in cases of frank congenital syphilis. Narich (1) expressed the opinion that frequently cases are found in nursing infants who are infected by their wet nurse. It appears that the upper eyelid is the most commonly affected because of its

[1] Read before the Pittsburgh Ophthalmological Society, Feb. 11, 1924.

[2] From the Service of the Allegheny General Hospital.

ILLUSTRATING ARTICLE OF DRS. EDWARD B. HECKEL AND LAWRENCE G. BEINHAUER ON "SYPHILITIC GUMMA OF THE EYELID. CASE REPORTS."

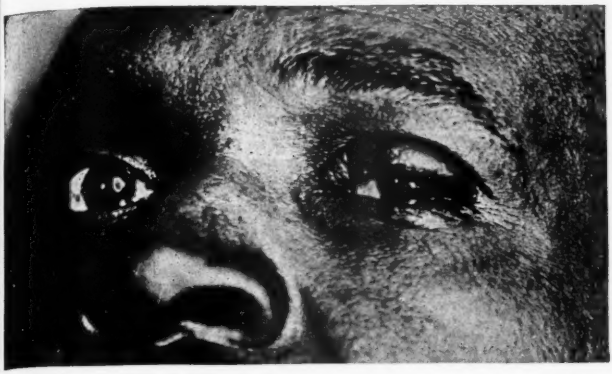


FIG. 1.

Note the ptosis, triangular defect and edema of the upper left lid

FIG. 2.

Note the lima-bean shaped ulceration involving the conjunctival surface; its punched out appearance and the scalloped fingerlike superficial ulcerative process extending along the lid margin with absence of the hair follicles. Note lack of inflammation reaction on the sclera of the eyeball.

FIG. 3.

Typical chancre of the eyelid used to contrast its appearance with that of the gumma.

FIG. 4 (Case 2.).

Note involvement of lower left eyelid; the drooping tumor mass through which an incision had been made. Inner canthus shows an ulcerative and softening process.

propinquity to the internal angle of the eyeball (1). Ordinarily, gummata appear from three to twenty years after the chancre, but it is always best to be on guard where the question arises, because there is an equally good chance for the development of the gumma of this region from nine to twelve months after the primary lesion.

FREQUENCY.

A gumma, strictly confined to the eyelid, is a rare condition when one considers the frequency of syphilis and the frequency of gummata elsewhere on the body.

Max Joseph (6) states gummata of the eyelids are uncommonly met with. Bull (7) reports, "Little is said of syphilis of the eyelids because lesions are better recognized and treated and are not common." Zeissl reported 8 cases of syphilis of the eyelid in 40,000 cases of syphilis seen, reporting 2 cases from Arlt's ophthalmic clinic. He stated, "Gummata of the eyelids are not common, but when involving the conjunctiva or tarsal cartilage are extremely rare." Clapp (8) states, "Tertiary lesions are frequently seen as a general thickening—tarsitis—while the circumscribed tumefaction—(gumma)—is the rarest of all specific lesions." Hutchinson (9) reports, "This condition is so rare that one, even in our large clinics, will see it seldom. Bock (10) quoting Zeissl reports a ratio of 8 in 40, 000 cases.

Narich (1) reports a ratio of 1 in every 10,000 cases of syphilis shows a gummatous involvement of the eyelids. Dornig (11) states the published cases of tertiary syphilis of the eyelids are very few and the same idea is held by Juliusberger (12). Bull (7) remarks "such modern writers as Arlt, Zehender, Bader, Wells, Heisung, Graefe, Fuchs and Schweigger make the rarest reference to it." De Schweinitz (13) admits it is not a very frequent condition. Alexander (14) gives the following statistics of the ratio of systemic syphilitic infection to the involvement of the eyes and adnexa (eyelids).

Siegmund	4,047 cases	.42%
Hebra	766 "	3.09%
Boeck	2,344 "	5.9%

Coccius and Wilhelm	8,000 cases	1.6%
Schubert	20,000 "	1.5%
Badal	10,000 "	1.14%
Bauerlin	20,000 "	1.06%
Eveille	10,000 "	3.03%
Ichi	50,000 "	2.76%

He further states that in 1385 cases seen by him, only .57% showed involvement confined of the eyelids and conjunctiva. On reviewing the literature it was noted most works reported were from foreign countries and thereupon a circular letter was sent to a group of selected ophthalmologists and dermatologists over the entire country inquiring their experience with this condition. From a group of fifty representatives of the leading medical centers of United States and Canada, only eleven returned positive replies and the total number of cases seen by these men was twenty, of which number Fordyce and de Schweinitz had seen the most cases (4 or more each).

CASE REPORT NO. I.

Mr. E. H., laborer, age 36 years, colored, married, presented himself at the dispensary on October 17, 1922, for examination of his left upper eyelid. Patient stated his father, age 70, is living and well. His mother died at 50 of pneumonia. He had five brothers and two sisters living and well. The patient had been married thirteen years. His wife had three pregnancies—two children living and well, one child died at 7–8 months (miscarriage). The patient had the usual diseases of childhood. Twenty years ago he had a Neisserian infection complicated by bilateral buboes, which were incised and drained leaving scars. The patient denied any penile lesion at that time, and denied any history of extra genital or secondary Lues.

The present complaint dated back to July, 1922, when he first noticed a slight but constant "rubbing" sensation on the under surface of the upper left lid. This symptom was the only subjective symptom noticed and for which the patient consulted medical advice. At that time, the patient stated he had a red, somewhat hard small pea-sized "pimple" with an oozing surface far back on the under surface of the upper left lid; also a similar "pimple" on the free margin of the upper lid 10 millimeters from the inner canthus. He then consulted medical advice at a local Eye Dispensary where repeated dark fields were made for the Spirochete

pallidum and found to be negative. A negative Wassermann was obtained and repeated Wassermanns after provocative tests proved negative. The patient was given an injection of the salicylate of mercury after which he stopped treatment because of fear of pain. During the interim, until patient consulted our clinic, no antiluetic treatment was given.

On examination the striking difference between the condition of both upper eyelids was very noticeable. The right eyelids showed normal outline of structure in all respects. The left upper eyelid showed a marked ptosis with a badly swollen, edematous, shiny and definitely solid thickening. On closer inspection there was noticed a definite pustulo-crusted infection of all hair follicles of the lid margin and the inner half of the upper lid. In comparison, the eyebrow region of the left side showed fewer hairs than that of the opposite side. Upon removal of the thick crust of the upper left lid, a deep triangular defect about 10*mm* from inner canthus, involving the entire thickness of lid, was revealed. The patient stated it was the site of nodule above mentioned.

The defect, which was obscured by the dried exudate, extended 6*mm* upwards involving the entire thickness of the lid including the tarsal plate. Extending laterally and medially from the defect, involving the inner half of the upper lid, was a hard, indurated, somewhat comma-shaped tumor mass. The tumor mass was deeply seated, free from the overlying skin which showed no reaction other than that of the necessary edema. The undersurface of the lid showed a well defined, punched out ulceration 15*mm* by 8*mm* located at the middle of the inner half of the upper lid. It was lima bean in shape, indurated and presented an uneven, muco-purulent base which showed early definite tarsal plate involvement. Extending laterally from the ulceration along the free margin of the lid for 8*mm* and involving the width of the edge of the lid, was a superficial finger-like process, the borders of which showed an irregular scalloped appearance. The hair follicles were destroyed in this area. The adjacent conjunctiva and adnexa were free from any inflammatory reaction except the inner canthus which was irritated by having been bathed in the pus from the ulceration itself.

The prearicular glands on left side of the face were very markedly swollen, painful and tender to the touch. The glands, three in number varied from a small pea to a large marble in size. These glands receded with subsidence of purulent infection of the eye itself. The submacillary, occipital and cervical glands showed a slight irregular shotty

adenitis. The lungs showed a healed fibrosis (old TBC) in both apices. The heart was enlarged 2.5*cm* to left midclavicular line, and apex beat was in 6th interspace. A very definite whistling murmur, early diastolic in time, was heard over the aortic area. The murmur was well transmitted up the neck and to opposite side of chest. No thrill was present. No enlargement of the aortic base was noted by percussion. The abdomen was slightly enlarged and showed a regular, non-tender liver. The spleen could not be felt. The extremities were negative. There was a marked shotty, irregular generalized adenitis. The inginual region showed a ropy, heavy, scarring from previous bubo infection. The neurological examination was negative. The pulse was regular, rapid (96), bounding but not water hammer in type. The patient claimed moderate exertion caused shortness of breath and slight coughing attacks.

Laboratory Examinations. Blood pressure 142–82.
Dark field (repeated)—negative.
Blood Wassermann—negative.
Spinal fluid—refused lumbar puncture.
RBC—4,250,000.
WBC—7,900.
Hmgl.—80%.
Urine—negative.
Differential.
LL 6%.
SL 68%.
Polys. 17%.
Trans. 8%.
Eosin 1%.

Smear and culture from lesion revealed a mixed streptococcus and staphylococcus infection. Smear and culture were negative for the Tubercle, Diphtheria and Ducrey Bacilli.

Fluoroscopic Examination of chest revealed a beginning aortitis with a widening of the aortic base.

Note.—Patient failed to return to clinic for five (5) weeks and when seen 12 hours before death by one of us (Beinhauer), was suffering from a severe pneumonia, accompanied by a marked dilatation of the heart, irregular, rapid (116), weak pulse and a severe nephritis. The urine showed heavy albumin content and abundant casts. The sputum was positive for Tubercle Bacilli. The condition of the eyelid showed a marked change. The ulceration was

healed, leaving no trace of previous disease except the fissure. It was from this healed-over lesion that we were allowed to make a biopsy, two (2) hours before burial of the deceased patient. The patient had received $\frac{1}{11}$ of a grain of bichloride by mouth three times daily during the absence from our clinic.

PATHOLOGY.

The section obtained from the eyelid was sent to Dr. Walter J. Highman of New York City to whom we are indebted for the preparation and diagnosis of the section. His report in detail is as follows:

LOW POWER. (Hematoxylin Eosin.)

The entire section is the site of an infiltration in strikingly vascularized tissue.

HIGH POWER.

The infiltration alluded to above consists of cells in longitudinal strands and roughly circular or oval islands, densely filling the field. These foci follow the axes of the vessels in relation to which they lie. The component cells are fibroblasts, lymphocytes and plasma cells. The last are numerous, but not crowded. There are no giant cells.

The media of many of the arterioles is thickened but not to an exaggerated degree. The intima is slightly swollen in places. The lymph spaces about the vessels are distinctly dilated and many of them are packed with lymphocytes. Other lymphatic spaces show similar changes.

COMMENT.

This section is that of an inflammatory granuloma. There is no evidence of neoplasm, either benign or malignant, and the absence of xanthoma cells precludes xanthelasmoidea. The conditions remaining to be considered are syphilis, tuberculosis and lepra, since the various disturbances caused by fungi can be readily excluded. In favor of syphilis are the arrangement of the infiltration; the number of plasma cells, which exceeds what is usually found in tuberculosis; and the changes in the vessels and perivascular lymphatics. There are no findings suggestive of tuberculosis, and the absence of giant cells is further negative evidence. Lepra may be excluded, among other

things, by the absence of lepra cells. In passing it might be added that none of the characteristic features of rhinoscleroma are present. By exclusion the specimen must be interpreted as syphilis.

Diagnosis: Gumma.

CASE REPORT NO. 2.

Miss P. W., age 25, white, single was referred by Dr. W. T. Kirk of Pittsburgh on October 6, 1924, for examination of a tumor mass on lower left eyelid. The patient's father died in an accident. The mother died at 24 of a typhoid-pneumonia. There were no brothers or sisters. At the age of 5 the patient developed an "eye condition" which led to blindness within six months and caused patient to be placed in a school for the blind. Thirteen months later under medical treatment the sight was restored and patient was given glasses for her eye weakness. No medical treatment was given until present illness.

The present complaint dated back two months, at which time the patient noticed a stye formation of the lower left eyelid which was accompanied by all symptoms of an acute inflammation. The "stye formation" gradually enlarged until it involved the entire lower eyelid giving a cystic appearance. At this time the patient's physician incised and drained the lesion with no beneficial results after which the patient consulted the above-mentioned physician.

Examination of the eyes revealed a drooping tumor mass of the lower left eyelid. The mass was angry in appearance, shiny, ham-colored and inflammatory. Palpation revealed a hard, indurated thickened mass, involving the entire thickness of the lid. The center of the mass shows a linear scar due to previous incisions. At the inner canthus is a punched out softening which involved the lid margin. The outer canthus shows a series (4) of nodules typical, ham-colored nodules with a circinate conformity. The cornea of both eyes show a healing interstitial keratitis but the left eye shows a deeper parenchymatous process. The iris is discolored and synechiæ have formed giving that pupil an irregular fixed outline. The conjunctiva of the left eye is injected. General examination of the patient reveals other stigmata of inherited syphilis. The patient has an eighth nerve deafness of the right ear together with a generalized adenitis, enlarged liver, high arched palate, irregular dentition—a typical but not true Hutchinsonian teeth—and suggestive scaphoid scapulæ. The blood Wassermann was negative but the tumor mass rapidly involuted under the therapeutic test of mercury and salvarsan.

We wish to report this as a gumma of the lower eyelid associated with congenital or inherited syphilis.

LITERATURE.

It is interesting to find the wealth of material, complete in every detail, which has been published about a condition which is considered by all as a rather rare condition. In reviewing the literature, one finds the earliest work on the subject was general and not confined strictly to the lesion of the eyelids which we call "Gumma" to-day, but, rather, included the so-called "venereal styes," "syphilitic sores," "syphilitic ulcers or inflammations," terms used generally to cover the lesions caused by syphilis. This early work began about 1738 and covered a period of years until about 1860. This early period might be considered the forerunner to period of 1860 to 1900, a period in which the literature was crowded by an abundance of important work through which the true character of the various syphilitic lesions affecting the eyelids, especially the gumma, were clearly recognized, studied, classified and treated. With the advent of the invention of salvarsan by Erhlich and the discovery of the Spirochete by Schaudinn, the more modern period of research on this subject was begun, but, as yet, has added nothing new to the works already written between the years of 1738 and 1900.

During the early period, the forerunner of our knowledge of to-day, we are given a series of remarkable works and observations. It appears that the first fairly clear case was reported by d'Astruc (15) in 1738. This was soon followed by the work of Plenk (16) who reported the "venereal styes" as they occurred on the margin of the lid. These writers and their contemporaries, as quoted by Bull (7), regarded all lesions of the eyelid dependent on syphilis entirely and either did not think the conjunctiva was ever involved, or when so recognized, they regarded the disease as having spread from the cutaneous surface of the lid. These were followed by the important work of Alibert (7) who summarized the literature of syphilis involving the eyelids, from 1806 to 1825. Lawrence (17) in 1830 followed by Campbell (18) and Mackenzie (19) in 1832 added more data, gradually breaking away from the

former ideas and tended toward establishing the proper recognition of syphilitic lesions. Middlemore (20), in 1835, added further to the growing literature, being the first to call attention to both the external (skin) and internal (conjunctival) manifestations of the disease attacking the eyelids. Later Cases (21) in 1837 described the "syphilitic sores" which involved the eyelids making no special differentiation. This was followed by a worthy contribution of Dohlhoff (22) in 1838. Colles (23) in 1839 and Gireandeau des St. Gervais (24) in 1847 followed with interesting contributions; the latter described a gummatous lesion which resulted in a symblepharon as a complication and such a sequela has never been reported since in literature. Heckel (25) states to have seen two or three such sequelæ following gummata of the eyelids. In the same year, Tavignot (26), Evans (27) and Desmarres (28) contributed to the literature. Tavignot (26) holds the distinction of being the first to clearly describe the actual syphilitic pathologic process as it attacked the eyelids. Holder (29) in 1851 gave special mention to this condition in his text on venereal diseases. Mackenzie (30) in 1856 and Von Stellwag (31) in 1858 completed the literature published in this early period. Of these writers Bock (10) states Lawrence, Desmarres and Mackenzie published the first important works in establishing the true nature of the gumma as it attacked the eyelids.

Between the years of 1860 and 1900, the most valuable observations on the gumma of the eyelids were published and it was through these observations—a confirmation of the earlier clinical and pathologic observations—that the true nature of all syphilitic lesions, as they affected the eyelids, were definitely recognized. In other words, during this period, the identity of the chancre, the secondary manifestations; the rupial syphilides, the papulo-nodular ulcerative syphilides and gummata, were most clearly defined. It is absolutely impossible to quote each individual author who contributed to the period as the length of this paper will not permit. We shall, therefore, merely quote the authors as they contributed to this period and shall lay especial stress on those works which appear to us as most important. Wedl (32) in 1861 was the first, according to Bock (10), to investigate the anatomic na-

ture of the gumma, but it appears from the literature reported that Tavignot (26) in 1847, was the first to describe the pathologic syphilitic processes which affected the eyes. Wedl (32) investigated the gummatous process observed in a young girl afflicted with Congenital Syphilis. He reported no distinctive or characteristic findings of gummatous syphilis in the lesion examined by him. The work of Wedl was closely followed by that of Wecker (33) in 1863; Zeissl (34) in 1864; Hirschler (35) in 1866; Magawly (36) in 1867; Samelson (37) and Estlander (38) in 1870. The earlier texts by Zeissl and others made only the slightest reference to this condition. Hirschler compiled a rather comprehensive review of all preceding literature and Magawly gave an excellent article describing the nature of "Tarsitis Syphilitica" with four detailed case reports. The works of Galezowski (39), Manthner (40) and Fournier (41) appeared in 1872; Vogel (42), Barbar (43), and Von Stellwag (44) in 1873; Manz (45) and Hirschberg (46) in 1874; Fauchon (47) and Ziemessen (48) in 1875; Weckus (49), Laskiewicz (50), Magawly (51), Hoch (52), Dietlen (53) and Graefe-Saemisch (54) in 1876; Zeissl (55) in 1877; Hutchinson (9), Bull (56), Fuch (57), Markiewicz-Jodko (58) and Pflüger (59) in 1878; Jullien (60), Blary (61), Hirschberg (62) and Falchi (63) in 1879; and finally Castello (64) and Wecker (65) in 1880. The best works of this period dealt with the pathologic rather than clinical nature of the disease. Papers by Vogel, Fuchs, Magawly and Laskiewicz brought out clearly the nature of the syphilitic involvement of the tarsal plate with excellent case reports of the same. Vogel examined a section clinically diagnosed "Tarsitis Syphilitica" and conveyed the idea, as verified by later writers, that the tarsal plate itself was seldom involved primarily but rather the process was a Perichrondritis (?) with a secondary involvement of the tarsal plate. The other works, as published, were more or less casuistic in form, the most noteworthy of these was that of Bull who published the best American article to that date.

Later, in the next twenty years a stream of constructive literature continued to appear. It began with Wiethe (66), Schubert (67) and Drewes (68) in 1881; and was followed by Streatfield (69), Perez-Ortiz (70), Zeissl (71), Calhoun (72),

and Von Stellwag (73) in 1882; Bock (10), Dornig (11), Juliusberger (12), Mittasch (74) and Solomon (75) in 1883; Von Brincken (76), Schenkl (77) and Williams (78) in 1884; Windsor (79) in 1885; Hirschler (80), Griffith (81) and Hirschberg (82) in 1886; Zeissl (83), Wedl (84), Markiewicz-Jodko (85) and Collins (86) in 1887; Hutchinson (87) in 1888; Finger (88), Alexander (14), de Lapersonne (89) in 1889; Raushoff (90) and Salzman (91) in 1890; Würdeman (92) and De Beck (93) in 1891; Stern (94) in 1892; Fisher (95), Grüder (96), Achilles (97), Gagnillon (98), Galezowski (99) and Ashitade (100) in 1893; Alexander (101) and Galezowski (102) and Elschnig (103) in 1895; Parenteau (104), Silex (105), Keber (106), Lutter (107) and Reiner (108) in 1896; Axenfeld (109) in 1897; Fage (110), Simon (111), Veasy (112), Feuer (113) and finally ended with Bull (7) in 1899. During this period, the true nature of the gumma was clearly established. Case reports were more frequent and clinical diagnosis was more accurate. The gumma was now receiving considerable attention. A whole chapter was devoted to gumma of the eyelids by Zeissl in his text book on Syphilis. Von Stellwag in his treatise gave a complete and exact bibliography of all previous publications and reported four interesting cases of his own. Alexander and Finger in their texts on Syphilis of the Eye—a very valuable book for the library—laid much stress on this condition; gave excellent case reports and reviewed an abundance of literature. Salzman, Raushoff, de Lapersonne, Grüder, Markiewicz-Jodko, Keber, Parenteau, Ashitade, Fisher, and others reported varied and interesting cases of gummata which involved the eyelids. Bull produced his second paper with four excellent case reports, reviewed the existing literature and added a contribution to American medical literature that was most widely quoted by foreign writers. Feuer described a case which came to autopsy and the pathological findings were those of congenital syphilis. Reiner described a case of a gumma which infiltrated the ocular bulb. Axenfeld gave excellent differential diagnosis of tumor masses of the eyelid and the gumma.

Recent literature on the subject has been less productive than one would expect. This is possibly due to the better diagnosis of syphilis, as it exists to-day, with a more strenuous

and earlier course of treatment, making the gumma still more infrequent than during the past. Colucei (3) and Parsons (2), in 1904 published works dealing with this subject. The former reported a case of gumma in a congenital syphilitic, while the latter, in his text, mentioned the frequency of the condition in women. De Wecker (114), Narich (1), Fisher (115) and Clapp (8) published articles in 1906. Of these, the work of Narich is outstanding and is frequently mentioned in this paper. The other named authors contributed interesting case reports. Von Michel (116) in 1908 was followed by Max Joseph (6) and Chavellerau (117) both of whom added notable case reports. Later, Neureberger (118) and Pasetti (119), in 1910, published reports of cases observed, the first named showing the similarity between the gumma and the epithelioma and reported a case complicated by an epithelioma. Fisher (120) in 1911; Luedde (121) in 1912; Gilmour (122) in 1915; Koegel (123) and Igersheimer (124) in 1919 added interesting case reports to the rapidly growing list. Igersheimer in his text—*Syphilis und Auge*—devotes very little space to this subject. The modern text books by de Schweinitz (125), Weeks (126), Fuchs (127) and others give special mention of this condition.

CLINICAL COURSE AND DIAGNOSIS.

We are always confronted with the necessity for a differential diagnosis in every branch of medicine and syphilis is always to be considered. We know syphilis can imitate most any disease and is capable of infecting or affecting any part, organ or system of organs in the human body. It is this complication we meet when considering syphilis, which as a gumma, very closely simulates a variety of well-known and yet very common eyelid affections and a close differential diagnosis is necessary. The variety of these affections which were at first considered other than syphilitic was striking and we shall consider only the common affections which are always confused with syphilis. Bull (8) classified syphilis of the eyelid into four stages: chancre, papular or tubercular, rupial ulceration and gumma. Considering the gumma he stated: "The process may be acute or chronic. It may be

localized or diffuse. When diffuse, the whole lid is swollen and usually other symptoms of syphilis are present. When the tarsus appears infiltrated, the name 'Tarsitis Syphilitica' has been given. The infiltration is then chronic and indolent and is usually located in the upper lid. There is no pain or sensation. The tumor is hard and resisting and is characterized by the hardness, a boardlike hardness. The overlying skin is of a reddish brown color. The lid cannot be everted and ptosis is present. The swelling is homogeneous and the overlying skin is not usually involved." Fuchs (8) states that diffuse gummatous infiltrative processes start as elevated spots in the skin and change in character only after months to large foul serpiginous ulcers. Hirschberg (62) describes ulcerative gummatous processes, which become hard infiltrated ulcerations with indurated bases, eroded edges resembling an infiltrated meibomian gland which has burst on the conjunctival surface. Lawrence (17) reported that a syphilitic ulcer commencing as a stye with a circumscribed swelling on the ciliary margin may occupy the whole thickness of the lid. It may be acute and attended with great inflammatory reaction and pain, rapidly destroying the affected part. It is phagedenic, with a red areola, sharp edge and foul surface. When chronic, these are swollen and have some hardness at the base of the sore with induration of the skin and very little loss of substance. Ulceration of the lid generally occurs with other syphilides and on the conjunctiva. Mackenzie (19) distinguished between nodular syphilis of the lid that ends in ulceration and lesions that begin in ulceration. Middlemore (20) says "syphilitic eruptions may occur either on the outer or inner aspect of the lid but that syphilitic ulceration always has for its first locality the conjunctival mucous membrane or the tarsal edge of the lid." Gireandeau (24) described a venereal ulcer causing a symblepharon. Fisher (120) described a case of gumma mistaken for a dislocated lacrymal gland. Hutchinson (9) called attention to the fact that universal thickening of the eyelid from unknown causes may develop into gummata. Again, it may be complicated by an epithelioma or resemble an epithelioma as reported by Neureberger (118). Often it may be only a part of a systemic, generalized eruption which appears elsewhere on the body as

quoted by Igersheimer (11), Gilmour (122), Cases (21) and Keber (106). It may assume an enormous size attaining the size of a hen's egg as cited by De Wecker (114). The lesion may be strictly confined to the palpefral conjunctiva as seen by Windsor (79). Streatfield (69) and de Schweinitz (13) reported the gumma may be only a secondary extension to the lids from a gummatous process involving the lacrymal sac. It may be mistaken for a dacrocystitis (121). It may be single as described by most authors, Juliusberger (12), Dornig (11), and Alexander (14), or it may be unilateral affecting the upper and lower lids of the same side as described by Grüder (96). Again, it may involve three lids as seen by Salzman (91) who described a case resembling a hordeolum affecting the upper right lid, one week later involving the opposite upper lid and ten days later the lower lid opposite to the lid originally affected. Again, it may involve all four lids symmetrically at one time such as described by Chavallerau (117). Würdeman (92) states "the infiltration into the subdermal areolar tissues does not always ulcerate but may remain for a long time and bear a close relation to a chalazion." Hirschberg (46) and others call attention to the fact that this condition is often mistaken and treated for an acute or chronic chalazion. Salzman (9), Lawrence (17) and others called attention to the early onset of a gumma which closely resembles that of a stye formation. Colucei (3) and Wedl (4) reported cases of gummatous infiltration of the lids associated with congenital syphilis. Evans (27) related an unsuspected syphilitic infection which destroyed the entire tarsal plate by ulceration. Pasetti (119) lays stress on the tarsal and conjunctival involvement in this type of infection. Narich (1) states, "It may take the form of a syphilitic tarsitis; that is to say, it is localized on the tarsal plate. It may, in a similar circumstance, be again, circumscribed or diffuse. One of the characteristics of this syphilitic tarsitis is that it never remains isolated and is frequently accompanied by various lesions of the eyeball, such as iritis, retinitis or irido-choroiditis."

The main point in the fate of the gumma is its differentiation from those analogous tumor masses of the eyelid which are found, at certain stages of their development, to be confused with the gumma. In this group are the chancre,

epithelioma, dacryocystitis, stye formation, chalazion, secondary syphilitic lesions and the rarer eyelid affections. In differentiation one finds the gumma usually is a cold process, free from surrounding inflammatory reaction, unless complicated with a true serpiginous or arclike conformity and has a definite punched-out appearance. It causes thickness of the tissue and is definitely indurated, a boardlike induration which is very characteristic. It usually causes a ptosis of the affected lid. The condition primarily begins in the muscle tissue (56) between the skin and the tarsal plate or at times even in the skin. The tendency toward discreteness is marked although it may be diffuse, in which condition the lesion may be uniform or characterized by a series of small nodules which become soft, ulcerated and blanched with a tissue destruction giving an aspect pathognomonic of a gummatous involvement. A true gumma does not involve the tarsal plate primarily. In a word, the gummatous process of the eyelids has the same common characteristics as any cutaneous gummatous lesion, and the process of growth—its conformity, induration, softening, ulceration and cicatrization—should be remembered to make the diagnosis more simplified. It again becomes evident that more attention should be devoted to a differentiation of these lesions to avoid any error in diagnosis. It is advised that if the clinical symptoms warrant, in face of the negative laboratory findings such as our case presented, a therapeutic test be given, preferably in the form of large doses of mercury to further verify or disprove clinical suspicions.

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THE VISUAL COMPLEX.[1]

By Dr. ABRAM B. BRUNER, Cleveland, Ohio.

THIS paper contains no original work, the purpose of the writer being to attempt to summarize our present knowledge and beliefs concerning the reception, transmission and interpretation of those external stimuli acting upon the organ of vision. The literature upon this subject is enormous and the bibliography at the end of the paper lists only the works from which I have taken the larger part of my material. The more we inquire into the extraordinary faculty of vision the more interesting and complicated does the whole process become. The visual process as a whole can be compared to a puzzle whose individual parts can be fitted together, but which has not yet been completely solved.

Investigation of the subject leads us into the sciences of physics, anatomy, physiology, psychology and philosophy. One needs not only to get some idea of the part which each one of these sciences plays but to form some idea of the correlation of the various processes. No attempt will be made to discuss any of the pathologic variations in what I have chosen to call The Visual Complex.

I. THE NATURE OF VISUAL STIMULI.

The light waves which serve as stimuli are minute vibrations in the ether and belong to the type of ether waves known as transverse. In other words, the molecular particles vibrate at right angles to the direction of propagation of the wave.

All ether waves consist of radiant energy and are identical in

[1] A paper read before The Medical Arts Club of Cleveland, Ohio. For purposes of publication the more elementary portions, relative to the sciences of anatomy and physiology, have been considerably abbreviated.

character, varying only in length and rapidity of the vibrations. So these waves form a series extending from vibrations of very minute amplitude to those of very great amplitude. The longest waves cause the sensation we know as heat, the shortest produce the chemical effects, while the intermediate waves give us the sensation of light. The waves that act visibly upon the rods and cones consist of those from about 723μμ (millionths of a millimeter) at the red end of the spectrum to 397μμ at the violet end, these limits varying for different individuals.

A. The Characters of Physical Light Waves.

1. Intensity of Amplitude of light waves means the speed with which the particles vibrate from side to side. An intense light wave acts more powerfully upon the rods and cones than a wave of less intensity. We learn to distinguish variations in the intensity of the components of the chromatic spectrum. But the intensity of sensation is bound up more closely with the white-black series than with the color series. The phenomenon of intensity is interpreted in the cerebral cortex as *brightness* and at the lower end of the white-black series is a point at which the stimulus just produces a retinal sensation and this point we call the point of *least perceptible brightness.*

2. Qualities of Visual Sensations.

a. The Series of Color Hues. Every appreciable different color is called a Hue or Color Tone and is due to stimulation of the retina by light waves of a definite length. But we do not distinguish an infinite number of colors and the average man today uses only eight or nine names for pure color distinctions. These are red, orange, yellow, olive, green, blue-green, blue, violet and purple. The purple group is sometimes divided into carmine and magenta, and the term brown is applied to a group of impure yellows.

The various attempts which have been made to explain color vision have brought into use the term *fundamental colors.* These will be discussed under the head of color vision.

b. The Gray or White-Black Series. Extends from the sensation of pure white to the sensation of absolute black.

Approximately 700 shades of gray can be distinguished by the human eye, ranging all the way from the most intense white to black, which latter is not the result of any light stimulus at all but physically corresponds to an absence of stimulation.

c. Mixed Series of Color-Shades and Tints. The various shades of gray may be combined with the various pure color hues. There is a color-shade series for each hue and the multiplicity of mixtures we can produce gives rise to a vast number of new color sensations.

If we mix a gray and a pure color hue of the same intensity of illumination we get an entirely different result. The resultant color is neither brighter nor darker but the visual sensation produced is entirely different from that of the pure color with which we started. We have caused not a change in color hue or color shade but a color variation known as *tint or saturation*.

d. Complementary Colors. For each specific hue in the spectrum, there is another hue which when mixed with the first will produce a mixture in which no color is observed, For a given yellow, one and only one blue can be found. which yields such an effect. Hence, this yellow and this blue are complementaries.

The total number of different visual sensations is determined by combining the number of pure hues, the number of gray shades, and the number of distinguishable color shades and tints. It has been estimated that there are about 30,000 distinguishable visual qualities.

3. Duration. The length of time the stimulus acts upon the end organ plus the persistence of sensation after the stimulus has been removed.

4. Extensity. The name given to indicate the difference between individual receptors. In other words, each individual rod or cone is affected in a slightly different manner even when the stimuli are identical.

B. Refraction of Light Rays.

Having a knowledge of the character of the light rays we must now consider, from a physical basis, the effect upon rays

of light by their impingement upon and passage through the eyeball. Rays of light strike upon the anterior surface of the cornea. A certain number of these rays are reflected backward and do not enter the eyeball. The remainder, in their course, pass into and through the eyeball to the retina. The alteration which takes place in direction as rays of light pass from a medium of one density into a medium of another density we speak of as *refraction*. In other words, the rays are bent in a definite direction, according as to whether they pass from a more dense to a less dense medium, or vice versa.

II. THE ANATOMICAL BASIS OF VISION.

From the anatomical standpoint the eye can best be compared to a photographic camera. It is unnecessary here to review the structural formation of the eyeball. For purposes of emphasis, however, I would make mention of the three more specialized portions of the retina, namely, *the blind spot*, *the macula lutea*, and *the periphery of the retina*.

The course of the optic nerve fibers and their connections with the cortical centers in the occipital lobes is too well known to require description here.

III. THE PHYSIOLOGICAL BASIS OF VISION.

At this stage of our discussion we come to the first great junction point in the visual complex. This might be described as the terminus where the physical stimulus is received and translated into a physiological process. I shall mention briefly only the physiological facts having to do with the visual process and not those having to do with the normal nutrition of the eyeball.

1. *Accommodation and Convergence.* These are arrangements of the dioptric mechanism of the eye which provide for the focusing of rays of light that proceed from a source less than six meters distant from the eye.

2. *Structural Changes in the Retina.* The chief structural changes are the phototropic reaction of the retinal pigment epithelium, the contraction of the cones, and the changes in the Nissl granules.

3. Chemical Changes in the Retina. The most important chemical change is the bleaching of the visual purple.

4. Electrical Changes in the Retina. By experiment it has been shown that the retina when connected with a galvanometer shows a "current of rest." On exposure to light there is at first a short negative variation followed by a longer positive variation.

5. Variations in Activity in Different Parts of the Retina. The acuteness of form vision falls off rapidly in passing from the fovea to the periphery, but on the other hand, movements of objects are more readily observed at the periphery.

Color vision is also markedly affected by the location at which the stimulus impinges on the rods and cones. Each color hue gradually fades into an unsaturated tint as the color stimulus passes from the center to the periphery. At the periphery all hues disappear and only distinctions of gray are observed unless the stimuli are very bright.

6. Color Blindness. A group of perplexing phenomena for which we have no scientific explanation but which are probably largely physiological in nature.

7. Adaptation: The Purkinje Phenomenon. This is concerned with the relative brightness of different hues varying with the intensity of illumination. It has also been defined as the automatic process of leveling the sensibility of the retina to the requirements of the moment. The retina adapts itself to light, dark and colors. Parsons has called a light adapted eye a "photopic eye," and a dark adapted eye, a "scotopic eye."

8. The Phenomena of Contrast. In an analysis of the physiology of the retina we can regard each rod and cone as capable of an isolated stimulation. When we produce stimulation of a cone area we can produce two very different reactions. These have been called simultaneous and successive contrast.

The phenomenon of simultaneous contrast is that when an area of the retina is stimulated there is a reciprocal reaction in the immediate surrounding areas. Successive contrast is that phenomenon known as after-images, which are distinguishable into what we call negative (or complementary) and positive after-images.

9. Fatigue. A group of phenomena undoubtedly of physi-

ological basis associated with prolonged or intense stimulation. The following effects have been observed in fatiguing the eye with color stimuli.

a. All direct sensation of the fatiguing color is lost.

b. The fatiguing color produces a homo-chromatic after-effect like a luminous fog.

c. Fatigue of one color has no effect upon the intensity of the remaining color sensations.

d. The eye fatigues more quickly for some spectral colors than for others and macular fatigue lasts longer than peripheral fatigue.

IV. COLOR VISION.

This subject has both a physiological and a psychological basis and might be discussed under either topic. Because of its great interest I have placed it under a separate heading but space does not permit me now to elaborate upon any of the interesting historical facts of color vision nor to discuss the various theories advanced to explain these intricate phenomena.

V. THE NERVE IMPULSE.

The preceding paragraphs have attempted to give our ideas of how the sensory neuron in the retina is excited. The results of the excitation are nerve impulses and each nerve impulse is a propagation of energy. The nerve impulse shows two sorts of variations, namely, difference in intensity and difference in mode.

1. *The Intensity* of an impulse means its activity and this can be measured at any point by the amount of activity, at that point, in a unit of time.

2. *Difference in Mode.* The mode of a nerve impulse may be pictured as due to a specific rate or frequency in the succession of impulses. For example, in light waves different rates or modes of wave vibration produce different and varying modes or rates of impulse in the optic nerve. This variation in mode occurs only in sensory nerves.

Among the fundamental operations of nerves are certain

factors or properties which serve to determine the nature of the nerve impulse in a given neuron.

(a) Excitation. Means that the end organ is capable of being stimulated as a result of receiving energy from without.

(b) Conduction. The ability to propagate an impulse along the nerve fiber, from one end of the axon to the other.

(c) Retention. The "trace" which persists in the neuron after the impulse has passed through.

(d) Metabolic variation. The anabolic and katabolic changes in the nerve substance itself.

(e) Summation or Fusion. An alteration in the nerve impulse due to several impulses from different neurons uniting together in a single higher neuron.

(f) Distribution. The dispersion of nerve impulses which have been gathered together in a sensory or central neuron.

(g) Modification. The modifying influence of one impulse upon another when the two are summated.

VI. THE PSYCHOLOGICAL BASIS OF VISION.

Having discussed how the physical stimuli come into contact with the sense organs of vision and there set up sensory physiological changes let us proceed a step further. These sensory physiological changes are transformed in the higher neurons into perceptions, and the perceptions so aroused with their qualities, attributes and interrelations now lead us into the domain of psychology.

A. The Definition of Perceptions.

We may define perceptions as mental states whose chief components are external sensations. The distinctive feature of a perception is that many nerve impulses coming in separately from external receptors are combined into a single complex experience. The separate sensory impulses from various neurons are combined and collected into a single higher neuron by the process, already made mention of, that we call summation.

Several important facts about perceptions should be briefly noted.

1. Perception takes place within the brain.

2. Certain objects and forces in our environment are not perceived at all, as for example, the ultra-violet rays.

3. The relations of objects and their parts are perceived with more exactness than the data warrants. For instance, in looking at a rectangular table top the retinal picture has two acute and two obtuse angles, yet we perceive the object correctly as a rectangle.

B. The Phases of Perception.

1. *Simple Perception.* When the whole field of vision is stimulated at once the impulses from the various rods and cones are carried separately to the brain and combined at the visual center. The resulting mental state is called a simple perception. In certain cases also the impulses from two similar but distant receptors unite to form a simple perception. This is what happens when so-called "corresponding points" in the two retinæ are stimulated and in this case the process is spoken of as binocular fusion. It is of interest to note that when different colors are presented to the two eyes the central result is not fusion but rivalry, as we perceive first one field and then the other alternately.

2. *Space Perception.* The ability to appreciate the distance and directions of things (and of their parts) from one another. This phase of perception besides depending upon slight individual differences in the rods and cones also requires the muscle sensations due to eye movements. These muscle or Kinesthetic sensations enable us to distinguish superficial distance and direction of movement and to discriminate between the one and the other.

3. *Depth Perception and Projection.* The perception of the distance of external objects from our body. This perception is not based upon "local" differences in the receptors but is due to a combination of non-visual data with visual impulses. The non-visual data we may divide into two classes, uniocular and binocular.

The uniocular factors.

(a) Sensations due to the play of the muscles of accommodation and convergence.

(b) Sharpness and clearness of outline and the blurring of objects because of increasing distance and atmosphere effects.

(c) Superposition. The effect produced by one of two objects being nearer the eye, the nearer object covering part of the more distant one.

(d) Shadows and Shading. Factors aiding us to see in Perspective and in Relief.

(e) Size and Shape of Familiar Objects and the Relative Positions in which we are accustomed to find them.

(f) Relative Motion of different parts of the landscape, nearer objects having a more rapid relative motion.

The binocular factors.

(a) The rôle played by the eye movements. We have already mentioned the sensations received from the actions of the internal and external eye muscles. The eye muscles act in several important ways as an aid to vision, namely, by the associated movements, by the production of fixation, and by the act of convergence. All of these actions aid us in locating objects in space.

(b) A second way in which binocular vision helps in the visual process is by the summation of stimuli in dark adapted eyes. Because of this the sensibility in dark adapted eyes is about twice as great with both eyes open as with only one open.

(c) Binocular Parallax. The principle of Stereoscopic Vision or Sense of Solidity. The ability to combine two different visual pictures from two different visual fields into a single definite impression. Stereoscopic vision can be analyzed into four elements.

1. The sense of seeing an object from two different aspects.
2. The sense of completeness of the image through the mutually complementary effects of two different images.
3. Shadow effects.
4. The augmenting effect of perspective vision.

4. Apperception or Focused Perception. This has to do with the unevenness in perception due to: differences in intensity of the stimuli, to variations in the receptors in the retina, and to variations in the metabolic conditions in the synapses. For example, in looking at a human face we do not

see clearly each individual feature but one or more of the features, perchance the hair, eyes or teeth, stand out more prominently than the others.

5. *Object Perception.* The dove-tailing together of the space relations in the several senses. For example, an orange may affect at once the eye, the skin, the muscles, the nostrils and the taste. As a result we see, feel, touch, smell and taste all at the same time and the combination gives us a mental state known as object perception.

6. *Perception of Time, Rhythm, and Events.*

(a) Time has to do with the persistence of the stimulus.

(b) Rhythm has to do with the evenness or unevenness of successive stimuli.

(c) Events. The grouping together of a succession of visual stimuli perceived as single events, such for instance as when we see a man walking or running.

7. *Discrimination or Perception of Differences.* This phase of perception is very highly developed in the visual sense. It is the appreciation of differences in two or more visual stimuli as regards their quality, intensity, duration and extensity. This allows us our fine judgment of perceptible differences in color hues.

C. *Relations of Visual Perceptions to Other Primary Mental States.*

Visual perceptions are closely linked up with the other primary mental states of Images, Feelings and Conations. Visual Images have as components the traces or modified traces of former visual sensations thereby giving us Memory Images and Synthetic Images. Visual perceptions also affect the mental state called Feelings, as for example, we are pleased by the sight of a beautiful painting. Lastly, visual perceptions have to do with Conations which are the motor responses to a sensory stimulus. A good example of this latter is the sight of a juicy peach starting the motor impulse to the salivary glands.

VII. THE PHILOSOPHICAL BASIS OF VISION.

In using the term philosophical basis, I wish to emphasize the many possible effects produced in the higher mental

states by the act of vision. Helmholtz has written: "The impressions of the sense organs are signs to our consciousness and it is left to our intellect to learn their meaning." So we might speculate very briefly on the complex mental processes that may be set in motion in the brain of man through the act of seeing. Sentiments may be made to fluctuate or emotions be stirred up; volitions may be induced or thought or reason set up; spoken and written language may be modified, and rational actions and idealistic thought stimulated. "Truly the light is sweet, and a pleasant thing it is to behold the sun."

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REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By Dr. DAVID H. WEBSTER, Secretary.

MEETING OF JANUARY 19, 1925. DR. CONRAD BERENS, CHAIRMAN.

Dr. E. M. Blake presented a case of **chorio-retinitis,** following influenza, in which at first there was seen some swelling of the disk.

First seen November 21st, 1924. Patient, girl of thirteen who had recently had influenza (?) complaining of blurred vision in the right eye. Examination of fundus showed nerve head blurred in outline and swollen 2 d. Swelling more marked in lower half of nerve. Veins distended. In the macula there was a white spot which appeared finely granular and glistened. Radiating from this area in a fan-like way, were innumerable small white dots, of a similar size. The dots were all uniformly white. Adjacent to the nerve were irregular white patches especially marked on the nasal side. These patches all lay under the retinal vessels. There was a large group of dots to the nasal side of the nerve. The periphery of the fundus was entirely free from these dots. The left nerve was normal except for a slight blurring of the nerve below.

In discussing the case Dr. Agatston stated that he had recently seen several cases of similar appearance, all of which were preceded by an optic neuritis. The choroidal spots appeared after subsidence of the inflammation.

Dr. Schoenberg had a similar case under observation, for the past two months with a receding papillœdema, in which the vision was improving.

Dr. Herbert W. Wootton presented a case of **hypermetropia** of fourteen dioptres, with $\frac{4}{8}$ vision each eye, with correction.

In discussing the case Dr. Duane stated that he had seen two patients in the same family, each of fourteen dioptres, with $\frac{4}{8}$ vision. They wear a plus 12.50 with comfort. Their parents had normal eyes.

Dr. McDannald had a case under observation of ten dioptres, with glaucoma.

Dr. Ralph I. Lloyd of Brooklyn, read (by invitation) a paper on **physiology of the retina in perimetry and campimetry**. (Lantern Slide Demonstration.) He illustrated the development of perimetry from Graefe's records of 1856–67, which were made on a simple flat surface with a central mark for fixation, through the contributions of Aubert and Forster with their observations on the effect of black and white backgrounds, to the evolution of the campimeters of to-day. He called attention to the differences in fixation of the central and peripheral parts of the retina and the limits of the central zone. Physiology of the suppression of an image in squint requires that the image fall outside this zone, and large deviations should always make one suspicious of a muscular origin.

He next explained Bjerrum's idea, and its great importance in the detection and measurement of the progress of glaucoma.

Dr. Luther C. Peter of Philadelphia, read (by invitation) a paper on the **clinical value of blind spot and central field studies** in intraocular and orbital diseases.

Dr. Peter first called attention to the vast amount of knowledge acquired by a central field examination, and the small amount of labor required to determine it. He stated that in sinus diseases the study of the blind spot should be part of a routine examination, to determine if there is any invasion of the visual pathway. The findings serve as a guide for operation, and place within the operator's hand knowledge as to the immediate visual results. In many instances the visual disturbance is increased immediately after operation. The greatest clinical value, however, is in cases which come to the ophthalmologist first where no clinical evidence of sinus infection is demonstrable. In myopia the blind spot enlargement is usually in the direction of the macula. In

differentiating between papilloedema and papillitis, peripheral field involvement may be found in the latter before any enlargement of the blind spot develops. The same is true in differentiating pseudo from true neuritis. In toxic amblyopia the field picture is unmistakable; an absolute central scotoma surrounded by a larger zone of color defect, which is only duplicated in that rare condition, Leber's disease. It is in glaucoma however, that repeated studies of the blind spot are imperative. They stand out as the most accurate and dependable aids in arriving at a diagnosis, and are essential to prognosis and treatment. In glaucoma essential and vital field pathology is found within the 20° circle. The Bjerrum scotoma in one of its many variations is altogether the most important symptom of glaucoma. By repeated observations one can tell which cases are to be kept under miotics, and which must be operated upon.

Discussion: Dr. Alexander Duane said that progress in perimetry is to be looked for in the direction of standardization. The latter should aim to effect uniformity and precision, first in the illumination, second in the test objects used. With regard to the latter we must seek to eliminate certain defects, which at present prevent our tests from being strictly comparable. These defects are: Glare from the test object and carrier; too great prominence of the carrier, distracting the patient's attention; variability in color hues and values; and deterioration of the test-objects by fading or soiling. To obviate the last mentioned difficulty he advocated the use of pinheads of various sizes appropriately mounted. These could be made in quantity and thrown away when they become outworn. As regards methods he relied very largely on the confrontation test and curtain. The former often gave valuable evidence especially in the case of paracentral scotomata, the tests used being either fine dots on cards or colored squares on a gray background of the same light values as the color. The curtain he used at 30 inches for larger defects, and at 60 inches for mapping central defects and the blind spots. The 30 inch distance gave a field extending over 40°, the 60 inch a field of over 20°. In mapping central scotomata he had found two measures helpful—Peter's ring and the extinction test. In mapping the blind spot, precision

was secured without undue waste of time by the double-object method and the vanishing test. In the former two objects were carried simultaneously toward or away from each other until the points were found where both disappeared at once. Thus one diameter of the blind spot was ascertained, and three or four others being found in this way, the outline of the blind spot was established. In the vanishing test the outline of the blind spot is first determined in the ordinary way and marked by a series of white pins, then the patient is told to move his head a little. If in so doing all the pins disappear at once the outline is at least not too large. If, however, simultaneous vanishing does not occur then the pins are shifted until it does. In closing Dr. Duane referred to Dr. Stevens' recording perimeter, apparently the first of its kind, which he had seen in Dr. Stevens' office, a few years after the instrument had been devised.

Dr. COLMAN CUTLER said each method had its advantage, but he prefers monocular to binocular fixation. The main thing is to study the patient with such a regard for essentials that small variations from the normal and rapid fluctuations indicating changes for better or worse are apparent, especially in retro-bulbar neuritis. He did not think the records of blind spots add valuable information in myopia, but in glaucoma their value was too well known to need further discussion. He did not think that recent swelling of the disk and œdema of the retina around the nerve, necessarily cause an enlargement of the blind spot. The symptom had been absent in some cases that he had examined. If there is marked choked disk there will undoubtedly be an enlargement of the blind spot due to displacement of the retina or interference with its function around the optic nerve, if the condition of the patient permits of an examination. The fact that papillœdema is not a usual symptom in sinusitis, although it does occur, makes the enlargement of the blind spot of greater value as a diagnostic sign in cases where there is no œdema. It is therefore important to determine whether intracranial pressure from any cause can produce œdema in or at the inner end of the optic canal which might simulate the symptoms which we have been prone to attribute to disease of the sinuses. As we know, tumors of the lobes and

chiasm, abscesses and aneurysms, may exist without papillœdema, and it is probable that changes in the area of the blind spot will prove an aid to early diagnosis. This consideration will make us less ready to attribute all cases of cæco-central defects to sinus disease.

MEETING OF FEBRUARY 16, 1925. DR. CONRAD BERENS CHAIRMAN.

Dr. H. H. TYSON presented a man with the **destruction of both eyes from caustic lye.** Age 36 years. Had his eyes severely burned, also his face by boiling caustic lye April 27, 1924. In spite of all treatment after about ten days the cornea sloughed off, followed by intense pain for a few hours, and the ocular contents were extruded with collapse of the globes and later symblepharon and ankyloblepharon. The loss of his vision occurred so suddenly that the patient cannot be made to comprehend that he is doomed to spend his remaining days in eternal darkness, and begged to be permitted to attend this meeting in the hope of finding some surgeon to hold out a ray of hope to him. He had been led to believe that he can be made to see again by having an eye transplanted from the head of the perpetrator of the horrible deed, into one of the orbits of his own head, and cannot be convinced to the contrary.

Dr. H. H. TYSON presented a case of **aniridia.** Man, age 43 years. Attended clinic Knapp Hospital September 24, 1918—gave history that piece of wood struck him in the right eye, two and one half hours previously while he was hammering it. Wound in cornea and iris extending from center to limbus, at about three o'clock, opacity in lens with hemorrhage upon iris, shallow anterior chamber. Vision, R. $\frac{20}{100}$, L. $\frac{10}{10}$. The possibility of the foreign body being a piece of steel, he was placed before the Giant Magnet of Haab, and was warned that if he felt any pain to tell us at once. After one or two trials without any bulging of iris or the slightest pain, upon the next attempt he pulled his head away suddenly from the magnet and groaned, by that time apparently the complete iris was hanging upon the tip of the magnet attached to the piece of steel about 3 x *2mm.* The eye was bandaged and made a rapid uneventful recovery. It is now almost seven years since the injury. The opacity in the lens has

not increased and vision with correction −0.50−0.50 axis 120 = $\frac{10}{10}$, and with plus 1.75 J. E. 14″. In order to determine what, if any effect miotics or mydriatics would have upon an aniridic eye, Dr. Tyson tried the effects of eserine 1%, and pilocarpine 1%; and homatropine 1%; atropine and the tension taken with the tonometer was equal in each eye. He is wearing a No. 2 tinted glasses, and experiences no discomfort from glaring, etc.

The interesting features in this case are that the opacity in the lens remained stationary over a period of seven years, with excellent vision and accommodation, and also that miotics and cycloplegics had an equal effect on both eyes.

Dr. F. C. KEIL presented a case of **plexiform neuro-fibroma**. and showed in connection Dr. Crigler's case with the same condition.

In discussing the Case Dr. Crigler described his method of operative procedure.

Dr. ISAAC HARTSHORNE presented a case of **medullated nerve fibers extending to the macula** in a child aged 9 Vision, $\frac{10}{10}$. The fundus shows up, out and also outward extending around the macula a continuous area of medullated nerve fibers.

There are, in this case, two points of particular interest, **First:** the picture shows the classical anatomic arrangement of nerve fibers spreading from the disk out and around the macula in a curved fan or raphe. Many of these individual fibers can be seen. **Second:** the blind spot record with stereocampimeter shows the transparency of these medullated fibers; the blind spot is normal and there is no central scotoma; also no definite scotoma could be charted in the field of medullation.

In his paper on "The Blind Spot," "The relation of the blind spot to medullated nerve fibers in the retina," in *J. A. M. A.*, Nov. 5, 1921, Harry S. Gradle concludes that while medullated nerve fibers as a rule cause enlargement of the blind spot, this enlargement seldom corresponds in size or shape to the ophthalmoscopic picture of the medullated area; hence these fibers are not entirely opaque to incident light and that the degree of opacity cannot be deduced from the ophthalmoscopic picture.

The term "opaque nerve fibers" is a misnomer and should be discarded for the proper term, "medullated nerve fibers."

Dr. Arnold Knapp reported: **A case of metastatic carcinoma of eyeball, with unusual features.** This case is unusual because the tumor was circumscribed, visible on oblique illumination and not flat, the intraocular tension was only 12 Schiotz, and the patient lived two years after the onset of the ocular metastasis.

Metastatic tumors usually appear in the eye at the posterior pole in the form of flat tumors about the optic nerve as the metastasis is conveyed by the posterior short ciliary vessels. They do not attain a definite height and grow like a saucer. The clinical picture is characteristic and the usual opthalmoscopic picture is well illustrated by this drawing. A few cases have been reported where the anterior ciliary vessels seemed to transport the metastasis and then the tumor appeared in the iris and ciliary body. The case which I am reporting, however, deviated from this by the presence of a solid, pink detachment which could be readily observed on oblique illumination similar to the usual choroidal sarcoma. The patient had one breast removed for carcinoma three years before. The eye condition seemed so unusual that a multiple tumor formation was considered, but the X-ray of the chest showed an infiltration in the right lung, a tumor mass in the upper mediastinum, and a single large gland at the left hilus, confirming general carcinomatosis, and enucleation of the eye seemed needless. The eye was, nevertheless, removed some months later in the patient's home town, and it was then found that the tumor was circumscribed, projecting into vitreous for 9*mm* with a base of 12*mm* resembling the picture shown in the Macmillan's case reported in the *Archives*, 1922. The tumor was an alveolar carcinoma like the original breast tumor. The patient died six months later from œdema of the lungs caused by pressure of the mediastinal growth. While the duration of life after the onset of the ocular metastasis is generally given as seven months, in this case the patient lived two years. Notwithstanding the size of the tumor, the intraocular tension was 12 (Schiotz), similar to the reduced-tension findings so frequently described in this class of tumor.

DISCUSSION: Dr. Cutler said: In 1904 he reported a case of a nurse who had had a breast amputated for carcinoma a year before. The attending physician reported that she had begun suddenly to suffer severe pain in the eye, and in three weeks, he noticed a small mass in the iris. He saw her and removed the eye for the intense pain which she was suffering. She was already in a state of general carcinomatosis and died in about six weeks, but the pain in the eye was relieved and the operation was justifiable. The rapid progress of the growth and the extremely rapid dissemination of the neoplasm, with the final large deposit in the liver, contrasted with the slow development of the case reported by Dr. Knapp. The tumor was limited to the iris and ciliary body and extended on to Descemet's membrane. The pathological report of Dr. Dixon is in the *Transactions of the American Ophthalmological Society*, vol. 10, page 43. He was able to find but two cases, at that time, of metastatic carcinoma in the anterior part of the eye, but he believed four or five have been reported since then.

Dr. Knapp did not think that these cases were usually bilateral; he had found the records of 25 cases in literature, and they were all unilateral.

Dr. MARTIN COHEN demonstrated a **combined focal illuminator with corneal magnifier.** An easily portable instrument with a powerful light.

In discussing the instrument Dr. Minsky showed some drawings of the anterior part of the eye seen with the May Ophthalmoscope used as a focal illuminator. Dr. Stevens thought Dr. Cohen's instrument of distinct clinical value. Dr. May was of the opinion that his ophthalmoscope was all that was necessary for an examination. Dr. Crigler said that he had used Dr. Cohen's new instrument, and that it is of great value when one could not use a slit-lamp microscope.

Dr. E. J. CURRAN of Kansas City read (by invitation) a paper on **cauterization in glaucoma.** (Reported in full in this issue.)

DISCUSSION: Dr. KNAPP: A new method to reduce intraocular tension is an important observation and we are all indebted to Dr. Curran for coming this long distance to give us first-hand information. The way scleral cauterization

over the ciliary region reduces tension opens the way for considerable speculation. I would like in this connection to remind you of Lagrange "colmettage" operation in which by making multiple cauterizations about the limbus he aims to raise intraocular tension in hypotony. There are always cases of absolute glaucoma on hand which are painful so that opportunities to try this operation should be plentiful. If future observations confirm the tension-reducing factor in Dr. Curran's operation, a real contribution to ophthalmic surgery has been made.

Dr. SCHOENBERG asked the ages of the patients and the period of time under observation.

Dr. BLAKE asked if a staphyloma resulted.

Dr. CURRAN answered that the operation had been performed on eighteen eyes, in ages ranging from 24 to 82. They had been under observation from three to five months, that in some cases the sclera did bulge a little, and in some cases there was a distinct depression.

Dr. WILLIAM M. MCLEAN read a paper giving the **clinical findings in forty phacœrisis operations**, with lantern slide illustrations and demonstrations of the lenses removed.

DISCUSSION: Dr. Clyde E. McDannald said that Dr. McLean was to be congratulated on his straightforward, honest presentation of his experiences, as he gave not only his good results, but laid particular stress upon his failures. Dr. McLean's results were better than his own. He attributed this to the fact that the instruction under Barrequer made him master of all situations. He wished to impress the following points:

1st. **Instruments.** He had had no experience working with the Barrequer hand instrument, having always employed the one devised by himself which has a large hole in the handle over which the index finger is slipped when the vacuum is desired. He agreed with Doctors Barrequer and McLean that the vacuum should be under control of the hand. The oscillating pump as devised by Barrequer would seem to be of some importance in rupturing the zonular fibers, while the lens is moulding into the cup. Slow vibration, Barrequer contends, cause the zonular fibers to break at the ciliary attachment, whereas rapid vibrations rupture them at the

lens attachment before they can be transmitted to the periphery, thereby eliminating traumatization of the ciliary body.

2nd. **Selection of cases.** No beginner should attempt to operate on a case under sixty. The younger the subject the more increasingly difficult the delivery becomes. With one exception, the only cases giving me trouble were under sixty. He should also avoid liquifying lenses.

3rd. **Injection.** He thought it was of importance to obtain if possible a paresis of the orbicularis. He does this by giving a deep injection of two percent novocain, at least a dram, 1½ *cm* temporally from the external canthus. He then introduces a long needle injecting along the full course of the lower lid, keeping about 5*mm* from the lid margin, being careful to carry it as far as the inner canthus. The same procedure is followed with the upper lid. Often by the time the injection is completed the patient is unable to close the eye. Never had he had any complaint of pain.

4th. For the beginner it is well to perform a complete preliminary iridectomy. It lessens bleeding at the time of operation and enables a larger section. With the buttonhole iridectomy there is no reason for making it in advance.

5th. **Application of the ventous to lens.** This should be made low as a necessity if the lens is to be tumbled, which is proper in delivering with a buttonhole iridectomy. In fact, this is the only rational way of drawing the lens through the uninterrupted pupil.

6th. **Results.** He noted that Dr. McLean reported two choroidal hemorrhages. In his series of cases he had one choroidal hemorrhage, one detachment of the retina, one prolonged irido-cyclitis with secondary glaucoma and loss of vision, and in one instance he picked up the vitreous, collapsing the patient's eye.

Dr. Hartshorne said he had just returned from San Francisco, where he had watched the Greens work. They were mechanical geniuses, having devised a modified Barrequer apparatus with a foot valve, with which they do the operation in fifteen seconds, using in addition to the vacuum a little pressure with the forceps below.

Dr. McLean said he preferred the lid retractor to injection anesthesia, also he preferred the hand controlled valve.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By MR. H. DICKINSON, London.

A meeting of the Section took place on January 9th, the President, Sir Arnold Lawson, occupying the chair.

Bi-temporal hemianopia due to Fracture of Skull.

Mr. Egerton Gray exhibited a patient, a man, who fell 12 feet and fractured his skull in 1911, the fracture being of a depressed character, in the frontal region. He lost consciousness and had severe epistaxis. Recovery of consciousness was at once followed by a complaint of diminution of sight. The man had had severe headache, and in certain postures there was diplopia; also smell was defective. Pupils were equal and active, and there was an absence of color scotomata. Neither albuminuria nor polyuria was present, and sugar tolerance was not increased beyond the normal. The man showed nystagmoid movements of the head.

Mr. J. H. Fisher considered that in order to cause the clinical picture the fracture must have extended across the roof of the orbit and involved the cribriform plate and the olfactory lobes, at the same time i nplicating the optic chiasma.

Congenital Blindness without Obvious Cause.

Mr. Rayner Batten showed two children, aged respectively 6 and 3 years (brother and sister) who were born blind, but he had been unable to detect any cause for this. Otherwise the children were healthy and well formed, and there

was no evidence of congenital syphilis nor of nervous disease. Wassermann, in both children and mother, was negative. In the boy there was plus 6 of astigmatism, and in one eye of the girl there was hypermetropia, and in the other, hypermetropic astigmatism. Both demonstrated a slow nystagmus.

Mr. LESLIE PATON referred to similar cases which he had been observing for a number of years, and which, at an early stage, also had head-nodding and nystagmus. In those cases there were fine macular changes.

Mr. J. H. FISHER pointed out that the boy had pallor of the disk, and the girl, thread-like retinal vessels, while in the lower part of the fundus some of the vessels were sheathed with pigment.

Mr. M. S. MAYOU spoke of a case aged 18 who was born blind, and whose disks seemed very similar to those of Mr. Batten's cases. Two years after he saw her, she died following an accident in the street, and the post mortem examination revealed large cysts occupying the occipital lobes, and the cysts consisted of a distension of the material of the posterior horns of the lateral ventricles.

Dr. FRANCHESCHETTI (of Zurich) said he thought it likely that these children had a familial disease, and that the absence of vision might be a result of color-blindness, in which also a fine nystagmus was often observed.

The Susceptibility of Nocturnal Animals to Ultra-violet Radiation.

Professor SIDNEY RUSS, D.Sc., (of Middlesex Hospital College) read a paper on a research in which he was engaged with Sir Arnold Lawson, on the susceptibility of nocturnal animals to ultra-violet radiation. It was instigated by the question, propounded during the War, as to the possibility of improving the night vision of Naval officers and ratings, seeing that operations had then to be carried out under minimal lighting, and keen perception was very valuable. It was suggested that by supplying to the eyes of these men minimal doses of light from the blue and violet end of the spectrum, those eyes might have more acute vision than the normal for dim and distant objects. This was tried, and resulted in an

increased acuity of about 15% in moderately rested eyes. It was found that the compass charts of the first Zeppelin which was brought down in this country during the War were illuminated by light from this end of the spectrum. A further question was as to how transparent the eye was to different regions of the spectrum. In human eyes procured for this purpose a small window was cut at the back of the retina and a quartz plate cemented on to that, so that the rays passing through could be analyzed; and a question Dr. Russ set himself to solve was the relative transparency of the eye to radiations from different regions of the spectrum. For this purpose it was sufficient to have, as the source of light, either an arc light of tungsten, or an ordinary mercury lamp. The object was so focussed that the spectral lines were suitably dispersed by the prism in operation.

The first experiment showed the human eye to be very absorbent to any radiation beyond a wave-length of about 3,800, and the question here was as to whether acuity of vision under dim lights was due to the transparency of the eye to radiations of shorter wave-length than 3,800. If so, it should show itself in a study of the behavior of the eyes of nocturnal animals. The same process was therefore gone through in the case of animals' eyes kindly supplied by the authorities of the "Zoo." The result Prof. Russ depicted on the screen in the form of spectographs, and there was seen to be a remarkable difference in the degree to which these ultra-violet radiations were transmitted by the eye as a whole. The eyes of the ox, the cat, the owl, the tiger were used, and it was found that the nocturnal animals had, in general, a very marked transparency to rays which apparently were not transmitted through the human eye. There was a considerable absorption of radiations within the range of normal vision. The night owl showed a considerable range of radiations capable of reaching the retina transmitted through the various media; there was also a definite range in the tiger's eye, but not so great as in the night owl. Some animals, such as the tiger, relied partly upon scent, and not entirely upon vision, but that was not, he understood, the case with the night owl. This large range he thought contributed considerably to the vision, and it was clear that shorter wave-lengths gave sharper

images than did waves of other parts of the spectrum. Increased time of exposure did not result in any more radiations getting through.

THE PRESIDENT suggested that there were three possibilities. The first was, that extra susceptibility to ultra-violet radiation might increase the consciousness of light in nocturnal animals, so that they were able to hunt successfully in a light so dim that human beings would find it practically useless. The second was, that there might be a greater power of image formation, the longer spectrum which was visible giving to the animal a keener image. Or, thirdly, the effect might be exerted in both those directions. Professor Russ' research just described seemed to constitute the best explanation yet advanced. It seemed a possible explanation of why people with apparently similar emmetropic refraction, differed so widely in their power of image formation. Perhaps people with keenest vision were those who were extra susceptible to ultra-violet radiation. People afflicted with night-blindness might suffer from a lack of ultra-violet appreciation.

Sir JOHN PARSONS, F. R. S., referred to previous work done on rabbits' eyes by himself, by Fowler, and by E. K. Martin, which did not seem to agree, in respect of the human eye, with that done by Professor Russ. A great difficulty in determining the absorption to various wave-lengths by the cornea, or by the lens, was that caused by the refractive effect of the tissues themselves. And a good deal of alteration was wrought by the fluorescence produced by the lens. The work of sensitizing the eye by dosing it with small quantities of radiation from the blue end of the spectrum was of much interest, and he spoke highly of a piece of work done in this direction by Professor Frank Allen, of Winnipeg. The speaker did not feel sure that if short wave-length radiations got into the eye they would increase its sensitivity and the acuity of its vision. The eye produced chromatic aberration, and all the radiations could not be focussed at the same time; what was usually done was to focus for the yellow region. It was a different matter with monochromatic illumination.

Prof. F. T. G. HOBDAY (veterinarian) said that Australian horses were selected for night work in Palestine because they did not have night-blindness. He thought this research

could be usefully continued on wild horses' eyes, such as existed in the Pampas of South America.

Prof. RUSS, in reply, said that after the general enquiry he had outlined, the eyes were separated out into their components and the latter separately tested. The lens was found to be the most absorbent of all the eye tissues, the cornea coming next in this property. The difference in the range of function in the various eyes tested he thought must be due to a varied range of transparency. The lens took on a marked fluorescence, and fluorescence argued absorption.

Mr. F. A. WILLIAMSON-NOBLE read a communication (illustrated) on **Inflammatory Pseudo-tumours of the Orbit.** He explained that the term set out in the title had a clinical rather than a pathological significance; it caused proptosis, limitation of movement, increase in bulk of orbital tissues, and perhaps swelling of the lids. There was a slow onset, and none of the usual signs of inflammation. Macroscopically, the orbital contents, if removed, might strongly suggest tumor. Benedict and Knight were inclined to attribute these pseudo-tumors to focal infection elsewhere, which had been overlooked in the absence of symptoms and leucocytosis. But the evidence must be carefully sifted, and this should not be made a sort of scrap-heap for otherwise undiagnosable conditions. Birch-Hirschfeld made three useful groups of this condition. In the first he placed cases in which the recovery was spontaneous, or took place after the use of iodide of potassium, mercury or quinine. In the second group an operation was performed without finding any tumor. The third group embraced the cases in which the macroscopical appearance of the orbital contents suggested tumor, but the microscope revealed a chronic inflammatory mass.

The first case related may be taken as a good example of the condition. It was that of a man, aged 25, who in July last attended hospital with marked proptosis of the right eye, and much conjunctival injection. Movements were full and normal. Rhinological examination was negative. He was treated with mercury and iodide at once, without awaiting a Wassermann test. Three weeks later there was some limitation of movement in the right eye, and the proptosis was more

marked. With glasses, vision in both eyes was $\frac{6}{12}$. A month later he was taken into hospital, and mercury inunctions and potassium iodide were continued for a further fortnight, but without reducing the proptosis. Exploration revealed a hard mass of tissue in the orbit, and no pus. Exenteration was performed a week or two later. He showed a photograph of the macroscopic appearance; there was a large white mass within the cone of muscles, molded closely over the posterior surface of the sclerotic and quite surrounding the optic nerve. The nerve itself did not seem to be affected. The vessels showed great thickening, both the intima and the adventitia; in some instances this caused obliteration of the vessels. This was, no doubt, a gumma. In a similar case reported by Hine the Wassermann was negative, and, concerning the value of the Wassermann test, Harrison stated that it was frequent to obtain a negative reaction in cases of syphilis when only a small syphilitic lesion was present, and that help in doubtful cases was sometimes derived from a provocative injection of salvarsan or a derivative.

Mr. Williamson-Noble's second case was that of a man aged about 50, who, following influenza, developed what appeared to be a lymphoma. The condition seemed to have been predisposed to by the lowered resistance due to the influenzal attack.

The remaining case of the condition was one in which a mass of young connective tissue formed as a result of irritation induced by the presence of cholesterin crystals. This was inflammatory only in the sense that it represented the reaction of tissue to injury.

The pre-operative diagnosis and treatment of the condition were very difficult. The presence of a lymphocytosis could not always be relied upon, as in two cases reported this was absent. The diagnosis involved a consideration of all the possible causes of proptosis, and he suggested that there should be an examination of the urine, especially for sugar. Also a Wassermann test, and if this proved negative, repeated after a provocative dose of salvarsan. Complement-fixation in regard to tubercle should be done, and a differential blood count, with a blood-coagulation time. And there should certainly be a search for focal infections, with radiography of teeth

and sinuses. Always the possibility of early Graves' disease must be considered, and an exploration should precede a decision to extirpate the orbital contents.

Mr. LINDSAY REA related a severe case of his own of similar nature in which the basis was syphilitic, though the patient denied infection. Vigorous antiseptic treatment—novarsenobillon, iodide of potassium and mercury—restored the eyes to their normal and the vision at the end of the treatment was $\frac{6}{6}$.

A meeting of the Section took place on February 13th, the President of the Section, Sir ARNOLD LAWSON, occupying the chair.

The Late Sir Anderson Critchett.

THE PRESIDENT made sympathetic reference to the recent death of Sir George Anderson Critchett, remarking that ophthalmology in general, and this Section in particular, had sustained thereby a loss which it would be very difficult to make good. During a long and distinguished career, Sir Anderson had filled every post in his own specialty which could have been offered to him, including those of President of this Section, of the Section of Ophthalmology in the International Congress of Medicine in 1913, and the Mastership of the Oxford Ophthalmological Congress, the last-named post being still in his occupation at his death. He was always a most courteous and dependable colleague, while among those who had his friendship he engendered real affection. Sir Arnold proposed a vote of condolence to his widow and family, and this was seconded by his friend of forty years, Mr. Ernest Clarke, who averred that the profession would never see a finer gentleman.

The resolution was carried in silence, members rising in their places.

Recovery from Pseudo-tumor of Orbit.

Mr. LINDSAY REA first brought this patient to the Section in June last, when both eyes were proptosed, the lids would

not meet, and the cornea had to be protected by a thin smear of paraffin applied two or three times daily, in consequence of which no ulceration occurred. The sinuses were examined, and one of them yielded mucus. The left antrum, left orbit, ethmoid and right orbit were all affected. Fibrosis had not occurred. N.A.B. was given in .45 of a gramme doses, with mercury inunction and the administration of iodide of potassium for three months. At the end of that time, the left eye, which had been blind, recovered $\frac{6}{9}$ vision, and the other eye now had similar vision. All that remained now to be done was to tie up the external rectus, which had been cut at an early stage, before the Wassermann reaction was known, in the effort to find the swelling.

Optic Nerve Tumor.

Mr. HUMPHRY NEAME brought up a man with a tumor of the optic nerve, with the object of obtaining opinions as to diagnosis and treatment. The patient's age was 45, and the family doctor noticed in 1918 that one eye was more prominent than its fellow. During the subsequent six years the proptosis had gradually increased, and it was now 7 *mm*, and in the proptosed eye vision was now only perception of light; there was practically no lateral displacement or rotation. The left eye was hypermetropic 6D, the right 1D. Lenses did not improve the vision of the left eye. The left disk showed a prominence of 4D above the surrounding structures at 5 disk diameters away, the disk seeming to be the summit of a convexity which was pushing into the eyeball, *i.e.*, it gave the suggestion of something being pushed forwards from behind. Wassermann 18 months ago and now was negative, and no disease of nose or sinuses could be detected. Still, the man had had iodides for 18 months. As to the nature of the tumor, the man's age was in favor of the growth being endothelioma. In a paper by Mr. HUDSON in the Royal London Ophthalmic Hospital Reports, 75% of cases of **gliomatosis** were said to have been in the first decade of life, and of the cases of **endothelioma** 50% were over 30 years of age. In **gliomatosis** visual defect was usually early, **proptosis** coming on at a later stage. In endothelioma there was generally more limitation

of movement than in the other varieties, but in this case the tumor might be far back. Pain was more common in endothelioma, and it was a symptom in this man.

Mr. LESLIE PATON reminded the Section of the case he showed at a clinical meeting of the Section last year having a very similar appearance. From that patient he subsequently removed an intradural tumor of the size of a sparrow egg, and it was a myxo-glioma. Subsequently the lids of the patient (a child aged 4) had to be sewn together on account of neuropathic keratitis. Recently there was a recurrence of the growth.

Optic Nerve Tumor.

Mr. F. A. WILLIAMSON-NOBLE also showed a case of **optic nerve tumor.** He said he had since come to the conclusion that it was probably an inflammatory mass in the orbit. The patient, a woman aged 63, noticed proptosis two years ago. Since October last she had been taking iodides, and the proptosis seemed to have become less in that time. An elder sister had cancer of the breast, and a younger sister had malignant disease of the eye. Wassermann and X-ray examination were negative. The blood showed a leucocytosis of 11,000, and the eosinophils were 5%. Inflammatory tissue appeared to be pushing the eye forward.

Angeioma of Retina.

Mr. KENDALL showed a man who noticed defective vision in the right eye in 1918. Vision in that eye was now found to be $\frac{6}{6}$ with a minus 3 spherical, and the vision in the left eye was also $\frac{6}{6}$, not improved with glasses. There had been no accident. The upper temporal artery on the disk was double the normal diameter, and the diameter was increased as it coursed towards the periphery. The companion vein was also very greatly dilated. The lower temporal nasal veins were also much enlarged, though their corresponding arteries showed little departure from the normal. There were several small recent hemorrhages. In 1924 the vision in the right eye, with glasses, was $\frac{6}{9}$, but in the left there was not even percep-

tion of light, the eye was divergent, there was a complete detachment of the retina, with large scintillating crystals at the back of the retina.

Discussion on the Ætiology of Miner's Nystagmus.

The remainder of the sitting was devoted to a discussion on the **ætiology of miners' nystagmus.**

Dr. T. L. LLEWELLYN opened with a general review of the subject, remarking that it was an occupational disease of the general nervous system, of gradual onset, and chiefly seen in workers at the coal face. He did not regard it as a local disease confined to the ocular muscles. His view received support from the fact that these men had headache and giddiness, and, in the severer cases, marked anxiety, mental depression, and disturbing dreams, as well as head tremor. Twenty-five per cent. of all men employed underground who were examined showed signs of the disease. Since the adoption of a more generous definition of the term, the applications for compensation under the government scheme had risen steadily, and in 1923 the cost of compensation in all industrial diseases was £600,000. The worker at the coal-face was a highly skilled laborer, who had to make his blows with precision, but in a very poor light.

Dr. Llewellyn said he considered that the chief factor in the production of the disease was the deficient illumination of the coal mine, due both to the low candle-power of the lamps used by the men, and to the great absorption by the coal of what light there was. Frequent symptoms were a delay in dark adaptation and an increased retinal susceptibility. The condition was more prevalent in winter than at other seasons, the symptoms came on after dark, and the recovery rate was greatest in summer. The age of the worker, the character of the shale, and the amount of attention he paid to his disease were all important factors in causation. Certainly the personal element was an important one, for men having an illness or sustaining an accident, such as to the leg, frequently attributed their condition to the nystagmus which they had endured without complaint for years. Three classes of cases were seen: those showing no neurosis, those with the disease

well marked and with definite neurotic symptoms, and those with slight or indefinite nystagmus in whom the dominant symptoms were neurotic. Both the rate of incidence and the recovery rate were improved by subjects of the disease working at suitable employment; idleness caused such deterioration as to render the subjects unemployable. He showed a number of instructive slides by means of the epidiascope.

Professor J. S. HALDANE said it was now clear that **miners' nystagmus** was brought about by using the eyes for the guidance of muscular movement when the absolute differences in the luminosity of objects seen was very low indeed. The latter might be so extreme as to prevent a distinction between white and black objects, however large. In foveal vision, with sufficient luminosity, the impression of consciousness with an eye fixed on the object was a lasting one, but with very low luminosity foveal vision lost its lasting character. When the eye could not be fixed on an object, the eye wandered about, and the result of momentary fixation and endeavoring to pick it up again was a fatigue which ultimately led to nystagmus. The disease did not occur where the men used oil cap-lamps. The illumination required to prevent nystagmus was that which allowed lasting foveal vision and therefore permitted objects to be fixed with the eyes. He did not consider that nystagmus was due to the gases present in coal mines.

Mr. H. S. ELWORTHY (Ebbw Vale) said that when making his investigations he was much impressed with the blackness of the coal mines, and he thought that could be best improved by introducing colors into the mines. He explained that by "better illumination" he did not necessarily mean greater candle-power. He believed there would be no nystagmus if the chromophotic index was over 500. When an oil-lamp was taken into a mine, the yellow and orange rays seemed to disappear, thus seriously reducing the illumination. Those rays re-appeared when the lamp was again brought into the fresh air. The eyes needed to be protected from ultra-violet rays, and exhaustion of the visual purple by those rays might explain the eye movements in nystagmus. Steam coal was found to reflect twice as much blue light as did house or anthracite coal, and nystagmus was much the most frequent among workers dealing with anthracite coal at the face. He

thought the carbon filament lamp could be regarded as ideal, it produced an excellent light for the purpose. In order to be within the margin of safety from this point of view, a light of at least 0.9 of a candle-power was needed. Among 4,600 men working underground in the Ebbw Vale group, there were 42 cases of nystagmus in 1914, but in 1924 there were only 7 cases. In the interval, the only change in equipment for the men was the provision of a yellow glass instead of clear crystal. At the present time, with the weekly compensation figure at 35/—, it paid a miner better to claim this than to work for three days a week where the economic conditions were bad.

Professor E. L. COLLIS, who illustrated his remarks with diagrams, pointed out that the supposed increase in nystagmus was apparent rather than real. An increase in compensation claims had occurred, due to the disease being an occupational neurosis, in other words a complex of a physical symptom and an underlying neurasthenia. Oscillation of the eyeballs was present in from 20% to 30% of miners working in poor illumination, without causing them inconvenience. In Belgium, the longest time a miner could draw compensation allowance was six months for this condition, whereas in this country there was no limit of time. When it was provided that the compensation could be claimed on neurasthenic symptoms alone, *i.e.*, without oscillation of the eyeballs, the number of claims rose, particularly claims from those who had had the disease for some time. There was good evidence to show that the increase in the claims was due to economic factors. Professor COLLIS considered that the important matter to-day was not nystagmus proper, but neurasthenia.

Mr. BINNS spoke from the standpoint of colliery owners' insurance, and said many cases certified as nystagmus were not so in fact, due to the fact that not all surgeons brought into relation with these cases were experts on it. Of 428 claims for the compensation, 32 were appealed against, and in 28 of those the appeal was sustained. He believed that canary-colored glasses had been found very useful.

Mr. G. H. POOLEY (Sheffield) confined his remarks to the personal factor in the disease, and this he divided into the personality of the observer, and that of the person observed. The incidence of the disease could only rightly be ascertained by

examining all the men working in a particular mine, and, if possible, under the actual conditions in which they were working. He had recently been investigating the effects of using light of 0.00006 of a candle-power, and found that with this the normal eye could detect color. A relative central scotoma was experienced. There was a point on the temporal side at which the visual acuity was greater than at the fixation point. Under these conditions there was much flickering and a sense of fatigue, and a moving object was seen more readily than a stationary one. When working in a very dim light it was very difficult to prevent the eyes oscillating. Some men with undoubted nystagmus played cricket, and in quite good teams, and refused to apply for benefit. Mr. Pooley thought that much of the so-called hysteria met with in connection with the disease was really **malade imaginaire.**

Dr. F. ROBSON said that the class of coal in connection with which most cases of nystagmus arose was the bituminous, and this contained a high percentage of volatile matter. Subjects of nystagmus might recover from it, but their return to the pit working was marked by a recurrence. There was no nystagmus in diamond, copper, tin and other kinds of mines, whatever the depth of the workings, and whatever lamps were used. Neither was the disease met with in the coal mines of America and South Africa, but in those of New South Wales this disease and "pink eye" were very prevalent. There, also, there was a great tendency to spontaneous combustion.

Dr. MILLAIS CULPIN said that **nystagmus**, as such, did not disable a man, and that the symptoms associated with the nystagmus were psycho-neurotic. He thought there was a close and suggestive association between the neuroses in this relation and those of so-called "shell-shock" during and following the war. This view was supported by Dr. C. F. HARFORD and Dr. H. W. EDDISON.

Mr. H. E. MITTON, a civil engineer with 7,000 men under his supervision, who had spent all his life among miners, said he was satisfied that nystagmus was due to the strain of working in insufficient light, and that there were great differences in response among different men. The process of "holing" increased the liability to the disease, owing to the miner's difficulty in getting light thrown on to the point he wished to

strike. This resulted in eye-strain. In his area, there had been an improvement in the incidence of miners' nystagmus from .95% in the year 1913, to .56% in 1924, due, he considsidered, to improved illumination. He was firmly of opinion that when a miner found himself suffering from nystagmus, he would be wise to continue exercise in some capacity, for extra smoking and comparative inactivity increased the symptoms and inconvenience of the disease.

A Clinical meeting of the Section was held at Guy's Hospital on March 13th, the President, Sir ARNOLD LAWSON, occupying the chair.

Dr. H. C. CAMERON showed a case of **bilateral facial paralysis with nuclear atrophy.** He had been taken to an eye hospital because of epiphora. The trouble extended upwards and involved the oculo-motor nucleus, the movements of the eyeball being very limited. The boy spoke well, except that he substituted t and d for p and b. The state had remained unchanged since the 2nd year of life.

He also showed a case of **cyclical vomiting, with ptosis.** Without any obvious exciting cause, he had attacks of prostration, pyrexia and vomiting, and he also had acetonæmia. The attacks were heralded by ptosis, by which his mother was warned of an impending attack hours before it occurred.

Mr. WHITEHEAD asked whether there was complete recovery between attacks. He called these fugitive spasms. He considered that true migrainous attacks were completely recovered from in the intervals.

THE PRESIDENT pointed out that in the first case there was complete conjugate paralysis of the lateral movements of the eye, but the patient could look up and down. Apparently there had never been any power of movement laterally.

Mr. A. W. ORMOND showed a case of **glioma of the retina** which had been treated by deep X-ray therapy. He saw the patient first when he was 7 weeks old; the glioma was so obvious that the eye was removed, and sections cut, and the diagnosis confirmed. At that date the other eye seemed to be quite good, but in a few months it became evident that a change was taking place in it, probably also gliomatous.

The question then arose whether it also ought to be removed, or whether there were any other measures which could be tried. The parents refused to have it removed. Dr. Watt thereupon commenced to treat it with deep X-ray therapy. Since that had been done there appeared to have been no advance in the disease.

Dr. WATT said deep therapy meant that at least 220,000 volts strength was being used, and this was driven through a special tube, with a complete vacuum, at 60,000 miles per second, and this, when it struck the target, generated very short rays, *i. e.*, about a billionth of a centimeter in length. 15 to 20*mm* of aluminium was used, which allowed the very short rays to play on the skin or part to be treated. He described the method of measuring the dose used. The dose for glioma was 80% of the skin dose. The conjunctiva would not stand so much as the skin This patient had had four series of irradiations, and the result was encouraging enough for it to be used on other similar cases.

Mr. ORMOND showed a case of **detachment of retina with a hole in the retina.** He said the patient was a lady aged 50, who came with the history that she had had some slight premonitory symptoms, that the condition of her left eye was not very satisfactory. Within a week she was suddenly aware of the fact that the sight of her left eye had become very bad. He found that there was a large detachment of the retina occupying a great deal of the upper part, and there was a large rent in the retina He advised that she should go home and rest flat on her back for three or four days. He put atropine in, and tied the eye up. He did not think it had made any difference in her condition, except that the position of the detachment had altered. She did not get quite $\frac{6}{60}$ vision, and the question was whether it was worth while to subject the patient to further treatment, such as puncture and keeping her flat on her back for several weeks.

Mr. J. H. FISHER advised the puncture of this eye. He had himself had two cases of recovery from detached retina in the last two years subsequent to galvano-puncture, and it was right to give a patient this chance.

Mr. GRAY CLEGG said his experience in this class of case was not very encouraging, because of hæmorrhage, though

now and again he got a good result. He agreed with Mr. Fisher that puncture should be done in this case. Much depended on whether the retina was mobile.

Mr. A. L. WHITEHEAD did not think the mobility of the retina had anything to do with the decision in regard to treatment. He believed that when there was a tear in the retina there was unlikely to be a new growth present, but in a person of 50 years of age without any obvious cause of detachment, his experience was that in the majority of instances it was a case of sarcoma.

THE PRESIDENT also advised puncture in this case.

Mr. ORMOND next showed a case of **arachno-dactyly.** He said that about half the 16 cases of the kind recorded had eye symptoms; *i. e.*, tremulous iris, congenital dislocation of the lens, and in some cases atrophy of the muscles of the iris.

He also showed a case of **hole in the macula.** The youth, aged 21, was struck in the eye by a racquet, and there resulted a rupture of the choroid and a hole in the macula. The eye was sound before the accident. Vision was reduced by the accident to $\frac{5}{36}$, and it had slightly improved since he was seen last November.

Several other cases were shown, chiefly of a neurological interest.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY.

Abstracts by Drs. A. N. Alling, New Haven; M. J. Schoenberg, New York; T. H. Butler, London; P. G. Doyne, London; and K. Wessely (*Archiv für Augenheilkunde*), Würzburg.

Edited by Matthias Lancketon Foster, M. D., F. A. C. S., New Rochelle, N. Y.

(*Continued from January issue.*)

II.—REMEDIES AND INSTRUMENTS.

33. Altschul. **Localization of intraocular foreign bodies.** *Fortschr. auf dem Geb. der Roentgenstrahlen*, xxix., p. 441.

34. Berens, C., Jr. **An accommodation rule with new features.** *American Journal of Ophthalmology*, January, 1923.

35. Birch-Hirschfeld. **Measurement of the pressure of the lid upon the globe.** *Zeitschrift f. Augenheilkunde*, 1922, xlix., p. 79.

36. Cheney, R. C. **The bactericidal power of argyrol.** *American Journal of Ophthalmology*, August, 1923.

37. Coulomb. **Qualités à rechercher en vue de la prothèse dans les moignons naturels et artificiels.** *Archiv d'Opthalmologie*, December, 1922.

38. Cousin. **Indication et résultats des injections sous-conjunctivales de cyaure.** *Ibid.*, July, 1921, p. 402.

39. Fage. **L'exenteration de l'œil et l'ophtalmie sympathique.** *Ibid.*, June, 1921, p. 391.

40. George, E. J. **Study of the ocular movements in the horizontal plane.** *American Journal of Ophthalmology*, October, 1923.

41. Gifford, S. R. and Cassidy, W. R. **Some uses of the slit lamp.** *Ibid.*, September, 1923.

42. Green, A. S. and Green, L. D. **Ophthalmoscopy by red-free light.** *Ibid.*, January, 1923.

43. Guist. **Diascleral illumination with the arc light.** *Zeitschrift f. Augenheilkunde*, 1922, xlviii., p. 219.

44. Hesky. **Sul valore scientifico e pratico dell oftalmoscopia con luce priva di raggi rossi, nonche con luce bianca e colorata in generale.** *Periodico d'oculistica*, 1922, numbers 3 and 4.

45. Kulenkampff. **Treatment of trigeminal neuralgia by injections of alcohol.** Meeting of the German Ophthalmological Society at Jena, 1922.

46. Lemoine and Valois. **Les sources lumineuses punctiformes a**

grand èclat dans la pratique ophtalmoscopique. *Archiv d'Ophtalmologie*, September, 1922.

47. LIPPINCOTT, J. A. **Local anæsthesia an adjuvant in ocular therapeutics: Is the process of absorption under nerve control?** *American Journal of Ophthalmology*, August, 1923.

48. MAGITOT. **Marsupialisation orbitaire et superiorite des greffes organiques de tissus morts pour établir un moignon mobile.** *Annales d' Oculistique*, clix., p. 644.

49. ZUR NEDDEN. **Technique of vitreous suction.** Meeting of the German Ophthalmological Society at Jena, 1922.

50. OGUCHI. **Osmosis of eye drops.** *Archiv f. Ophtalmologie*, 1922, cviii., p. 363.

51. PACALIN. **Etude theorique et pratique de l'image renversee du fond de l'œil.** *Archiv d'Ophtalmologie*, October, 1922.

52. SATTLER. **The fundus in red-free light.** *Zeitschrift f. Augenheilk.* xlviii., p. 295.

53. SHAHAN, W. E. **Selective thermotherapy.** *American Journal of Ophthalmology*, December, 1923.

54. WEEKER. **La prothesis oculaire par le modelage.** *Archiv d'Ophtalmologie*, January, 1921, p. 40.

55. ZIEGLER, S. L. **The use of the prism scale to neutralize and center spectacle lenses.** *American Journal of Ophthalmology*, September, 1923.

CHENEY (36, **The bactericidal power of argyrol**) has performed numerous laboratory experiments with the results that he thinks argyrol has a definite germicidal action, especially if the bacteria are well separated rather than collected in masses which the drug cannot penetrate. In spite of these findings he does not believe that the drugs commonly used in the conjunctival sac with the exception of nitrate of silver are of much value except in perhaps preventing reinfection. We have as yet very little real evidence as to the usefulness of these antiseptics since the actual clinical conditions cannot be reproduced in the laboratory.

COUSIN (38, **Subconjunctival injections of cyanide of mercury**) injects *1ccm* of a solution containing *1mg* cyanide of mercury, *2cg* novocain and *2ccm* distilled water, from two to eight times at intervals of two or three days. He has found this treatment to be well borne and to give good results in ulcus serpens and in infected wounds of the globe. When no improvement is noticeable after the first, or at most the second, injection, the treatment should be discontinued as otherwise cicatricial deposits in the meshes of the episcleral tissue will be produced unnecessarily.

KULENKAMPFF (45, **Treatment of trigeminal neuralgia by injections of alcohol**) divides this form of treatment into three classes: 1, purely peripheral injections; 2, deep injections, and 3, the methods of local numbing by injections of alcohol and destruction of the trophic center by injections into the ganglia. He also thinks the differentiation of intraneural from perineural injections important and says the former is shown by four symptoms: 1. Increase of the paræsthesia appearing during the injection. 2. Higher pressure required for the injection. 3. Paræsthesia in the most distant peripheral parts of the nerve. 4. Sudden onset of anæsthesia.

LIPPINCOTT (47, **Local anæsthesia an adjuvant in ocular therapeutics**) thinks that absorption of mydriatics and miotics is greatly facilitated by first anæsthesetizing the cornea because the corneal nerves exert an inhibitory influence.

OGUCHI (50, **Osmosis of eye drops**) recommends to make solutions of zinc used for collyria isotonic with the lacrimal fluid by the addition of one per cent. of common salt. But such an addition impairs the efficiency of solutions of atropine and of adrenalin.

SHAHAN (53, **Selective thermotherapy**) explains the technic of using the thermophore and claims good results in the treatment of tumors on the surface of the eyeball. With lesions on the lid he has had less success as the temperature necessary to affect the tumor is destructive to the normal tissue. In hypopyon keratitis this method is highly effective if the heat is applied with the proper care. ALLING.

MAGITOT (48, **Advantages of the introduction of dead tissue to form a mobile stump**) makes an implant of proper size and shape from the cartilage of the breast bone of a calf, places it in a twenty per cent. solution of formalin and leaves it for eight or ten days, and then replaces the solution with distilled water in which the implant is left for two weeks longer. It is then ready to use in place of the eyeball after enucleation. He says that extrusion occurs only after infection, the formation of a hæmotoma, or when perichondrium is absent. When no extrusion has taken place within the first fourteen days the operation may be regarded as permanently successful.

According to ZUR NEDDEN (49, **Technique of vitreous suction**) the following points in technique must be carefully ob-

served. 1. Regarding the quantity of vitreous to be taken: in iridochoroiditis and spontaneous hemorrhages into the vitreous 0.2*ccm* suffices at first, but with old netlike opacities more must be taken, up to a maximum of $\frac{8}{10}$*ccm*, leaving 0.5*ccm*. 2. The operation should not be repeated in less than three weeks, except in cases of infection of the vitreous, when shorter intervals may be advisable. 3. The caliber of the canula depends on the nature of the case. When the vitreous is very fluid a more slender canula is preferable, but in ordinary cases the best lumen is 0.6 or 0.7*mm*. 4. As a rule the puncture should be made directly through the sclera. Scleral incisions are generally to be avoided, but in exceptional cases, when the tension is very low, and in spontaneous hemorrhages into the vitreous, the puncture may be facilitated by a posterior sclerotomy. In aphakia a slender canula may be introduced at the sclero-corneal margin and passed through the pupil into the vitreous. After discission of after cataract in aphakia the aqueous and vitreous mingle, so that sometimes in these cases a considerable clearing up of vitreous opacities may be secured by paracentesis, but the clearing up will be better and quicker when the vitreous is sucked out directly with the syringe.

As it was impossible during the war for patients to personally visit artificial eye makers WEEKER (54, **Modelling for artificial eyes**) made a cast of the cavity with paraffine with a melting point of 60° beneath the closed lids from which the manufacturer could shape the artificial eye. Along with the model was sent information concerning the size of the cornea and of the pupil, the color of the iris, and other details. Well fitting prothesis were thus obtained in some very difficult cases.

COULOMB (37, **Artificial eyes**) is of the opinion that for double walled glass eyes which may be worn constantly the stump should not be more than for one half to two thirds the size of the original eye. It should at any rate be materially smaller than when a simple shell is to be worn.

FAGE (39, **Exenteration of the eye and sympathetic ophthalmia**) urges the most painstaking removal of the contents of the globe and destruction of the remains of the ciliary processes with the thermocautery. He believes that with this precau-

tion this operation is to be preferred to enucleation, even in cases of sympathetic ophthalmia. It is certainly the choice in all cases of panophthalmitis.

ALTSCHUL (33, **Localization of intraocular foreign bodies**) divides the methods employed in the X-ray localization of intraocular foreign bodies into three groups: 1, gross procedures, in which two exposures are made at right angles to each other; 2, methods in which the position of the eyeball remains unchanged while the tube is moved about; 3, those in which the tube remains stationary and exposures are made while the eye looks in various directions. To mark the anterior surface of the globe upon the photographic plate tin-foil may be used, or better Wessely's glass prothesis with the part corresponding to the cornea made of lead glass. By the second method, with unmoved eye, the position of the foreign body with relation to the apex of the cornea may be determined, by the third its position with relation to the center of rotation, hence the latter method is preferable when the foreign body is deep seated.

BERENS (34, **An accommodation rule with new features**) has devised a rule which is a modification of those used by Prince and Maddox. A string one meter long is attached and used in some of the tests. It contains a—*mm* scale for measuring the interpupillary distance, a stenopaic hole to determine possible improvement in vision, a near muscle test with readings in prism diopters, a small dot and line for determining the near point of convergence, a protractor for estimating the axis of the cylinders and small colored test objects.

BIRCH-HIRSCHFELD (35, **Measurement of the pressure of the lid upon the globe**) describes an instrument made of two metal plates with a spring between them. The closed plates are slipped between the lid and the eyeball and then the distance the spring is able to separate them is read off on an attached scale. An increase in the lid-globe tension is frequently found in high myopia and in exophthalmos, and the presence of an increased lid pressure seems to favor the development of a pannus in trachomatous eyes.

GEORGE (40, **Study of the ocular movements in the horizontal plane**) has devised an instrument with the aid of which he has determined that the center of rotation is practically a

fixed point for the excursion of the eye to either side for 50 degrees about the primary position. In passing farther toward the temple or nose the point becomes variable. Assuming the optic nerve to be 4.5*mm* from the macula, the cornea during an excursion of 60 degrees moved 15.86*mm* but the optic nerve moved but 9.73*mm*. The center of rotation is therefore excentrically located nearer the posterior pole on the nasal side. They believe that Donders' observations to be inaccurate.

GIFFORD and CASSIDY (41, **Some uses of the slit lamp**) illustrate the advantage of the slit lamp by a series of cases. Among them are posterior synechiæ and pigment flakes on the anterior capsule which were clearly demonstrated as were folds in the lens capsule following traumatism. Most instructive are the observations on the changes in the lens and vitreous. The authors quite agree with Vogt in his attempt to classify cataracts under 15 or 20 types. The slit lamp is of great assistance in differentiating the various forms, some of which cannot be seen with the ophthalmoscope. It also aids in predicting the progressive or stationary character of the lens opacity.

GREEN and GREEN (42, **Ophthalmoscopy by red-free light**) think that the glass screen introduced by Zeiss is superior to other filters especially that of Vogt which is much more cumbersome. The most important feature of ophthalmoscopy by red-free light is the visibility of the retinal fibers and of lesions of the retina and optic nerve. The choroid is seen less distinctly as the short rays of the spectrum have less penetrating power than the longer ones. Lesions of the cornea stand out clearly against a yellowish-green background. Hemorrhages of the retina and pathological conditions of the vessels are clearly shown. Although this method will not replace ordinary ophthalmoscopy it is likely to become more popular.

HESKY (44, **Red-free light in ophthalmoscopy**) says that the paleness of the papilla is clearly perceptible in a commencing optic atrophy when viewed with red-free light. In contrast with this, when diffuse or direct sunlight is employed the papilla is almost always pure white in youth, so that a diagnosis of atrophy is nearly impossible, while in older persons the yellowness of the lens makes the papilla appear yellow even

when it is atrophic. When red rays are used exclusively one obtains a homogeneous red picture of the fundus without perceptible details of the smaller structures. With red-free light the fundus has a yellowish tone which becomes more marked with the age of the lens, the disturbing reflection of red rays from the choroid is absent, which gives the retina an opaque, post-mortem appearance, the retinal vessels appear black on a bright background and may be traced to their finest ramifications. Minute hemorrhages can be seen and commencing pathological processes in the retina can be perceived earlier than with the usual means of illumination.

SATTLER (52, **The fundus in red-free light**) recommends the use of Vogt's red-free light for the investigation of minute changes in the retinal vessels and very minute retinal hemorrhages, for the study of the retinal reflexes, for the demonstration of the striation of nerve fibres, for the better observation of the yellow spot, for a more accurate study of diseases of the macula, and for the better perception of a yellow staining of the lens by oblique illumination.

GUIST (43, **Diascleral illumination with the arc light**) has made an apparatus by means of which the entire anterior segment of the eye can be illuminated in such a way as to make possible the study of the differences in the transparency of the tissues. The light shines through the iris except at its pupillary edge. The lens can be recognized through a circular shadow produced by total reflection of the light in the region of the equator. When the iris has little pigment the tips of the ciliary processes can be seen. The dark, frequently indented, or a serrata ring is found 6 or 7*mm* from the limbus, and in front of this bright zone, usually with meridional striation, the orbiculus ciliaris, adjoining the dark ring of the ciliary body. When properly used this new method of transillumination reveals pathological conditions in the posterior segment of the globe; for instance, when a tumor exists with a detachment of the retina it can be diagnosed through the shadow it casts within the otherwise translucent swelling.

LEMOINE and VALOIS (46, **Punctate sources of light in ophthalmology**) have devised a stenopaic lamp which, by means of a system of plano-convex lenses and diaphragms similar to that of Gullstrand's slit lamp, produces a very small, clear

point of light to use for skiascopy, oblique illumination, or ophthalmoscopy.

PACALIN (51, **Theoretical and practical study of the inverted image**) first studies geometrically the inverted image of emmetropic, hypermetropic, and myopic eyes, and shows that the size of the inverted image is dependent on the refractive power of the lenses used. The papilla is magnified four times when a convex lens of 15 D is used, seven times when one of 8 D is employed. Further he shows how the size of the image is influenced by the distance between the lens and the eye, and what observations can be made concerning astigmatism. The influence of the accommodation and of interposed convex lenses upon the perception of the inverted image is also studied, as well as the enlargement of the image by use of single or double lenses.

ZIEGLER (55, **The use of the prism scale to neutralize and center spectacle lenses**) has devised a scale by means of which the strength of the prism may be determined. The prism is laid over the scale and readings taken. The rule also may be used in determining the center of a lens.

(*To be continued.*)

BOOK REVIEW.

VIII.—**The Routine Examination of the Eye.** By BASIL ALNG, London. Edward Arnold & Co., London. pp. 156. Price $2.00.

This little book is designed to train beginners in Ophthalmology, in the methodical examination of the eye, the idea being that after practicing, the examination of all the structures and functions of the eye, the ophthalmologist will not be guilty, in later years, of omitting any important observation.

The author advises that his book be read during the examination of the eye, and in the presence of the patient or "dummy," who may be a fellow student, and that as each new structure or function is taken up, its method of examination be read and re-read until it is thoroughly understood.

This method of teaching may be somewhat novel as applied to the eye, but it is the method we have always used in the study of practical anatomy, and in fact in the study of all laboratory subjects, and so, its value had been proved.

For convenience the book is divided into three parts: External Examination, Subjective Examination of the eyes, Examination in the dark room.

On account of the size of the book the presentation of certain subjects, such as Muscle Balance and Field Taking, is necessarily elementary and incomplete. On the whole the methods described are reliable and well presented, so that the book adequately fulfils the purpose for which it was written.

A. H. T.

OBITUARY NOTICE.

JULIUS HIRSCHBERG, 1843–1925.—One generation goeth and another generation cometh! A steady procession,—yet it is possible to distinguish periods in human affairs, characterized by such marks as are left by great events, by great disasters, by gifted leaders, by the opening of new avenues of development and progress.

In the history of ophthalmology the period beginning with the middle of the nineteenth century stands out as the modern period. The triumvirate Helmholtz, von Graefe and Donders revolutionized the science of ophthalmology. The invention of the ophthalmoscope opened up a new world of study and every branch of inquiry and investigation in the physiology and pathology and therapy of the organs of vision yielded a rich harvest. Ophthalmology quite outstripped its sister sciences. Among the disciples of this ophthalmological triumvirate many achieved renown. Liebreich, Zehender, Alfred Graefe, Herman Knapp, Leber and others have passed away. The last survivor of this distinguished group was Julius Hirschberg, whose death occurred on February 17th of this year.

Born in Potsdam in 1843 he studied in Berlin and became a disciple of Virchow, Du Bois-Reymond, Helmholtz and more important than all in shaping the course of his life, of von Graefe. His intimate acquaintance with von Graefe came about in an interesting manner. During the summer of 1866 a cholera epidemic raged in northern Germany. Hirschberg, who was then working in the pathological laboratory in Berlin, was sent by Virchow to serve as assistant physician in one of the cholera hospitals. A few weeks later von Graefe, who himself had taken charge of another cholera hospital, asked Virchow for an assistant. Virchow transferred Hirschberg

to von Graefe's service. In the following autumn he was appointed assistant in von Graefe's eye hospital and served here for two years.

Among the disciples of von Graefe none were more industrious, careful or observant gatherers of clinical facts than was Hirschberg. The *Centralblatt fuer Praktische Augenheilkunde* which he founded in 1879 and edited throughout its existence for forty years, bears testimony to this. The *Ausgewaehlte Abhandlungen*, a collection of his shorter publications between 1868 and 1912 and republished in 1913 as a *Festschrift* on his 70th birthday, a volume of 864 pages, covers the whole field of ophthalmic practise. His earliest book, *Glioma of the Retina*, appeared in 1869. In 1876 and '78 his *Clinical Contributions* were published; his *Introduction into Ophthalmology*, in two volumes (1892 and 1901) was a work along original lines. In the ophthalmological publications of the last 30 or 40 years no author is quoted more frequently than is Hirschberg. One can truly say that there is no branch of ophthalmic inquiry that was without deep interest for him. He was among the first to apply aseptic methods in the operating room. It was Hirschberg who introduced the use of the electromagnet in ophthalmic surgery and applied it with great success. His profound knowledge of mathematics enabled him to formulate the *Mathematical Basis of Medical Statistics* (1874). To his wide knowledge of Latin, Greek and Arabic we owe the *Lexicon of Ophthalmology* (1887), the translation and publication of the ophthalmic works of Aetius of Ameda (1899), of Avicenna (1902) and of the *Arabic Oculists* (1904–5); but the outstanding accomplishment of his long and fruitful literary activity, the work which will forever remain a monument to his industry, his critical acumen and the breadth of his view and his knowledge, his erudition, is his *History of Ophthalmology;* based upon careful research in the original sources, this work of almost 5000 pages, is the most comprehensive medical historical work that has ever been published, not of ophthalmology alone, but in the whole field of medical history. It is not exaggeration to claim that Hirschberg has produced a complete history of ophthalmology; in doing this he has shown to the medical world the wealth of the heritage of ophthalmology.

It is amazing how much Hirschberg accomplished. He was frugal with time. He had his home in the same building that housed his private hospital. On the first floor he conducted his large polyclinic and held his lectures. His attractive apartment, his study, his library, his consulting room occupied part of the second floor. The rest of the building was devoted to hospital purposes, a well appointed operating room, wards and private rooms. Within these four walls all his work was done. He rose early and at eight met his assistants in the operating room; operations were first in the order of the day's work. Then followed rounds and dressings. He spent the rest of the forenoon in his study. At one he met his class, at two the polyclinic service began, at four he saw private patients. Late in the evening he again made rounds in the hospital. Some of his evenings were given up to the theatre, the opera, to concerts and to the pleasures of society, but most of his evenings were spent in his study.

His clinical work was characterized by great accuracy and care, and he demanded from those who assisted him the same painstaking study; every case of importance passed through his hands for revision and he did not fail to find whether anything had been omitted or overlooked. At no clinics was the field of vision recorded more frequently or more carefully; accurate measurements were made in every case of diplopia; sketches were drawn of external and fundal lesions as a matter of routine. His clinic won the reputation for accurate study. His careful records, clinical histories, descriptions, drawings and pathological preparations were gathered and it was this wealth of study that furnished him with the material for his voluminous publications. This was the school in which he trained his many pupils.

Every ophthalmologist who spent any time in Berlin or even passed through the city was sure to visit this mecca at 36 Karlstrasse. There were always visitors at the clinic,—visitors from everywhere and Hirschberg received all with the greatest cordiality and took real pleasure in showing them his patients, his methods and his work. His extraordinary linguistic accomplishments enabled him to speak to most foreigners in their native tongues,—in English, French, Italian, modern Greek, etc.

Hirschberg's medical interests were centered in ophthalmology, but they were not limited to ophthalmology. The entire field of medicine was his province and in his work and his writings he laid great stress on the relation of diseases of the eye to diseases of other parts of the organism and systemic diseases. He was a regular attendant at the Berlin Medical Society and took a lively part in the discussions.

Hirschberg's interests outside of medicine were catholic. They led him to spend his long vacations in foreign travel. For each journey he prepared himself by extensive study; from each he brought back interesting observations and experiences which appeared as articles or books,—*Parisian Eye Clinics* (1876), *English Eye Clinics* (1877), *Tunis* (1885), *Egypt; Historical Studies* (1890), *Journies to America* (1888 and 1905), *Visits to Greece* (1910), *Around the World* (1894).

In later years Hirschberg removed his home from the hospital and in 1907 withdrew entirely from active practice so as to give his entire time to the completion of his magnum opus, the history of ophthalmology; the first part appeared in 1899; volume after volume followed, the final volume in 1918. He was seventy-five years old at its completion.

Hirschberg was greatly aided by a devoted and cultured wife, who died a number of years ago. He had no children. Like a great physician and oculist who lived nine hundred years before him, he also might have said: "These books shall be my posterity, they shall perpetuate my name!"

During the war Hirschberg found diversion in interesting Shakespearian studies, which were published later. After the war he delivered a course of lectures on *Hypocratic Medicine* (1922). Only a few weeks before his death his last publication appeared, *Mendel's Notes on von Graefe's Lectures*. His devotion to von Graefe never flagged.

One might write much about Hirschberg's writings, about his gifts as a speaker in addresses and in conversation, about the clarity, purity and elegance of his language. He was a lover of art and music; his speech and his writings reflected his keen sense of beauty of form and of harmony of style. But this note is only to indicate the great service Hirschberg has rendered to ophthalmology.

The German edition of these Archives was under his editor-

ship from 1879 to 1882. It was through Hirschberg that the separation of the publication into two Archives was brought about, for at first it was devoted to both ophthalmology and otology.

I last visited Professor Hirschberg in the summer of 1923 and found him less vigorous, but just as interesting, his mind and his unfailing memory just as clear as in the days when it was my privilege to assist him in the old clinic. He did not give the impression of a man of eighty.

American ophthalmologists owe honor to his memory, for the kindnesses he showed those who worked in his clinic or visited him, for the valued lessons we received at his hands in his lectures, discussions and writings. And we owe a special debt of gratitude for his exhaustive *History of Ophthalmology in America*.

The last of von Graefe's disciples, he labored hard and long to promote the ideals of Graefe, Helmholtz and Donders.

HARRY FRIEDENWALD.